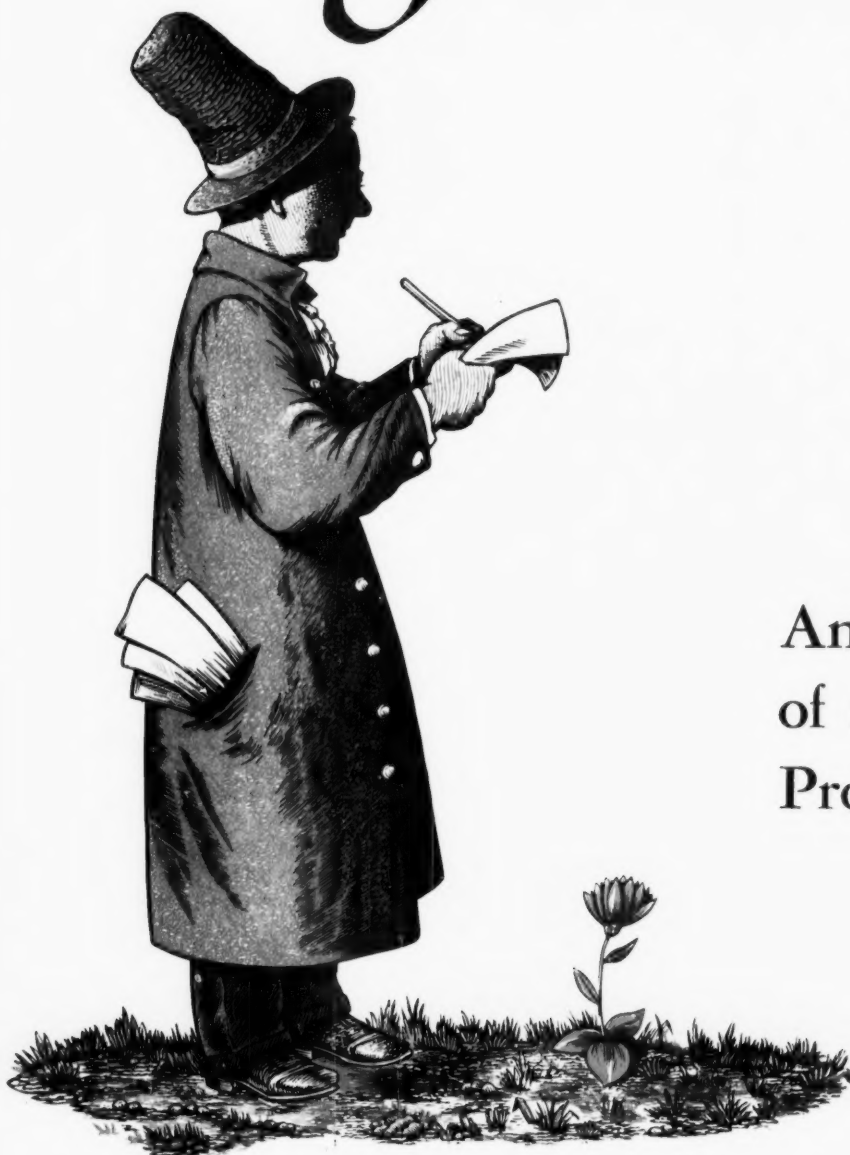
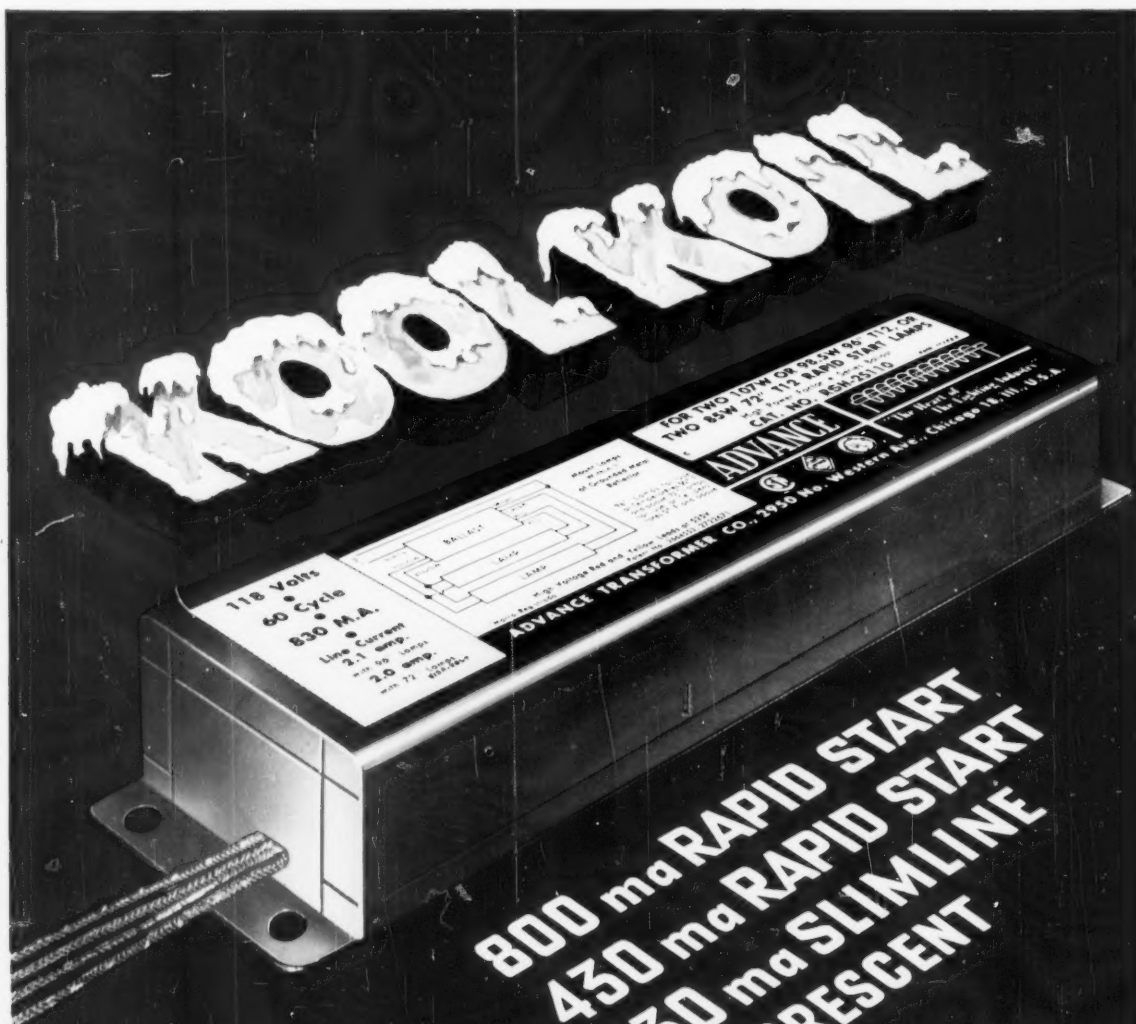


# *Consulting Engineer*

JANUARY 1959

Annual Survey  
of the  
Profession





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Salk Hall and campus photo courtesy of University of Pittsburgh.

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# How to Harness High Velocity Air

... facts about the selection of control units for efficient design, constant cfm delivery, and simplified stabilization of a system

Design and balancing of high velocity systems are greatly simplified by correct selection of currently available air control units. Three basic types meet all requirements: 1. *air valves*; 2. *constant volume regulators*; 3. *double-duct control units combining valves and regulator*.

These controls can be used independently or in combination, their application depending upon available duct

velocity in single- or double-duct systems; 2. controlling double-duct hot and cold air mixing; 3. balancing low velocity ducts or take-offs. Air valves cannot provide constant cfm delivery when there is variation in static pressure in the system.

Model F valves operate very quietly when handling high velocity inlet air. They can be mounted directly behind

tical lining is required downstream from the valve.

**Constant Volume Regulators.** New Barber-Colman SCR constant volume regulators maintain constant cfm delivery regardless of static pressure changes in the system. Operation is illustrated in Figure 2. A static pressure increase or decrease above the diaphragm forces it downward or upward, controlling the open area of the baffle plate. Acoustic lining insures quiet operation.

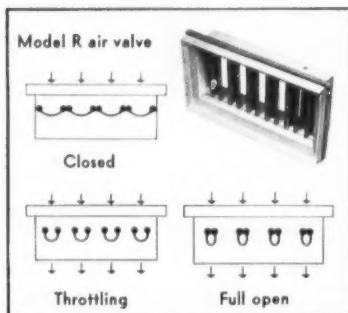


Fig. 1 — Motor-operated valves are widely used in double-duct systems for mixing of hot and cold air. Manually operated valves are used in branch ducts or take-offs to reduce velocity and/or balance the system.

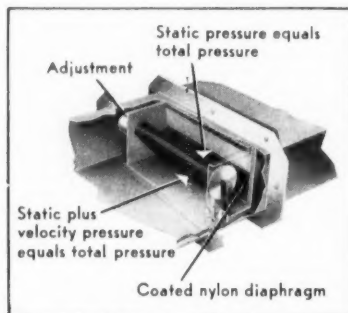


Fig. 2 — SCR volume regulator maintains constant cfm delivery for inlet air pressure differences up to 6:1. No power source required, the regulator operating on as little as 0.50 inches static pressure.

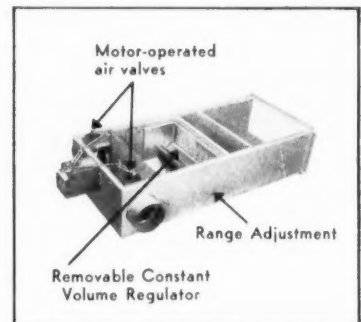


Fig. 3 — Model CV double-duct control unit combines two motor-operated valves (Fig. 1) and a constant volume regulator (Fig. 2) to provide accurate temperature control, velocity reduction, and constant cfm delivery.

space, noise control, balancing requirements, and other variables.

**Air Valves.** Manual or motor-operated valves throttle air flow for: 1. reducing

Uni-Flo diffusers when moderate noise level is permissible in the occupancy zone. When Model R valves are used to handle high velocity inlet air, acous-

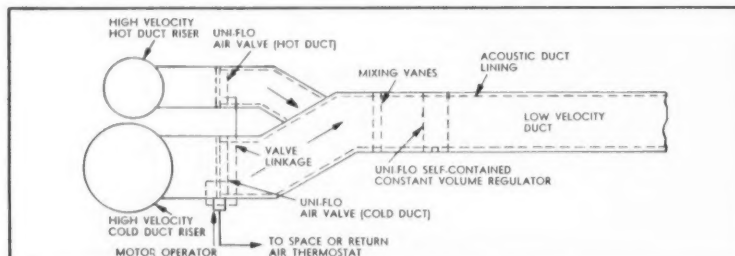


Fig. 4 — Double-duct system with motor-operated valves for hot and cold air mixing. SCR regulator maintains constant cfm delivery to the low velocity duct. NOTE: Model CV unit (Fig. 3) could be used instead of the two valves and SCR regulator.

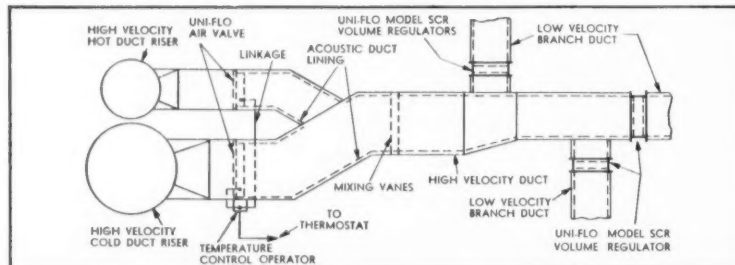


Fig. 5 — Double-duct high velocity system with Model R air valves controlling mixture of hot and cold air. Constant volume regulators in branch ducts make the system self-balancing.

SCR units greatly simplify design and stabilization. When they are used in branch ducts, the system becomes *self-balancing*. (Fig. 5)

## Double-Duct Control Units.

Another boon to designers and installers is the Barber-Colman Model CV Control (Fig. 3) — two motor-operated air valves and a constant volume regulator in one compact unit. Model CV accurately mixes hot and cold air and delivers constant cfm at reduced velocity. Acoustic lining provides quiet operation.

**Send for new bulletin.** Valuable high velocity system design data is contained in new Bulletin No. F6598-1 available upon request. Call your local Barber-Colman field office or write:



**BARBER-COLMAN COMPANY**

Dept. M, 1160 Rock Street, Rockford, Illinois

CONSULTING ENGINEER

# Consulting Engineer

Wayne near Pleasant Street  
Saint Joseph, Michigan

The Consulting Engineer's Professional Magazine

January 1959 • VOLUME XII • NUMBER I

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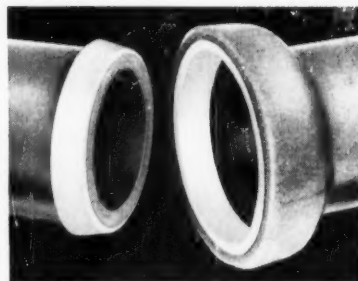
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Due to the tightness of the joint, ground water cannot enter the line. Since infiltration is eliminated, the sanitary sewer does not have to carry anything other than that for which it

was designed. This permits the use of smaller sized pipe in many instances and will reduce material cost.

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The design of the Amvit Joint assures self-centering which gives a smoother invert and better flow characteristics. Because the joint is really tight, no foreign matter such as dirt, sand, and stones can possibly enter the line.

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SINCE 1848



**American Vitrified  
Products Company**

CLEVELAND, OHIO

# How Much Steam Should a Steam Trap Trap?

... some answers to commonly asked questions  
about the primary job of a steam trap

You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap *all* the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

## A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

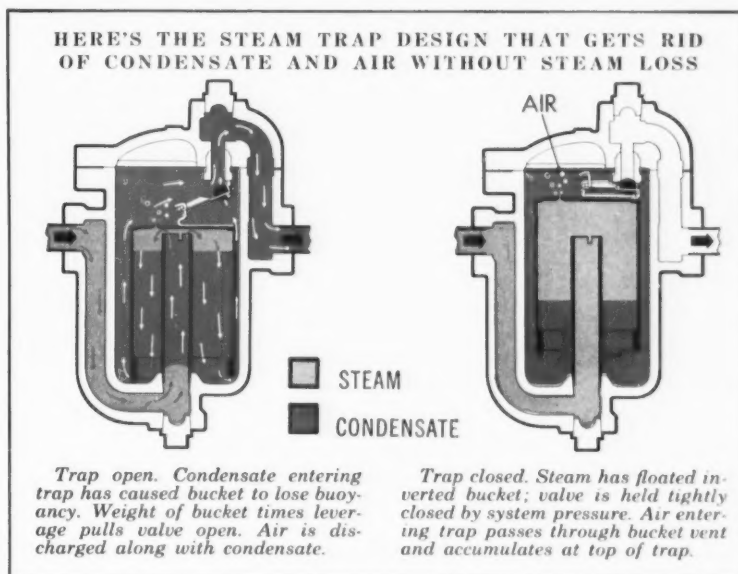
## A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

## A Steam Trap Should Remove Air and CO<sub>2</sub>

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. CO<sub>2</sub> goes into solution to form



corrosive carbonic acid which, for example, can eat unit heater tubes. O<sub>2</sub> aggravates the situation. Believe it or not, but all traps don't properly remove air and CO<sub>2</sub>.

By now, you've probably guessed that Armstrong traps *do* remove air and CO<sub>2</sub>. Armstrong design (see illustration) provides continuous venting of air and CO<sub>2</sub>. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

*Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.*

## What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

## Put Up or Shut Up

We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

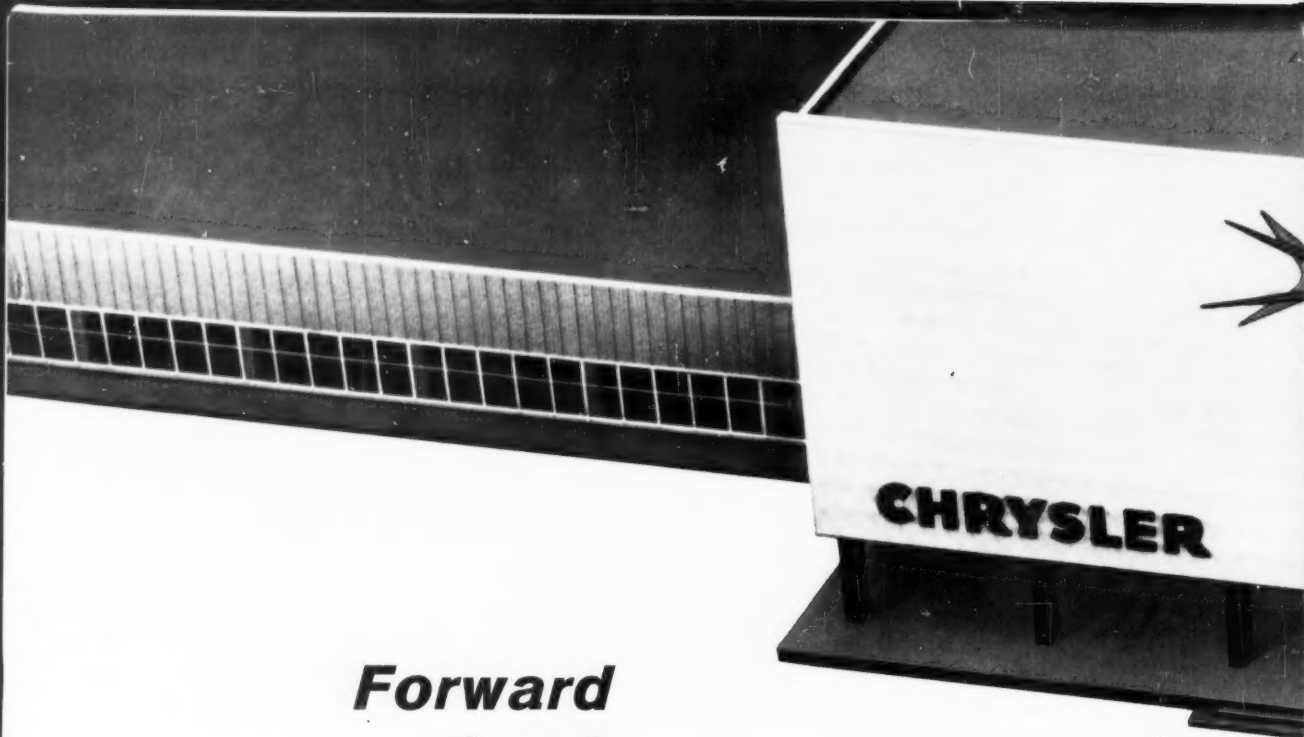
\* \* \*

The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

Armstrong Machine Works  
9651 MAPLE STREET  
Three Rivers, Michigan



**ARMSTRONG  
STEAM TRAPS**



# ***Forward Look in POWER*** **at Chrysler Stamping Plant with**

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Associated Architects and Engineers, Inc., Detroit

## **Prime Contractors**

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Hatfield Electric Co., Cleveland  
Robert Carter Co., Detroit  
Bethlehem Steel Corp., Pittsburgh

**E**NORMOUS load requirements—46,000 kva—constituted a utility-sized project in the design of a power distribution system for Chrysler Corporation's new 34-acre stamping plant at Twinsburg, Ohio.

After analyzing specific requirements of the plant the consulting engineers, in close cooperation with Chrysler's engineers, designed a selective system which assures continuous power service for 260 presses ranging in speeds from 10 to 30 strokes per minute; stamping forces up to 1600 tons; welding loads; and lighting loads.

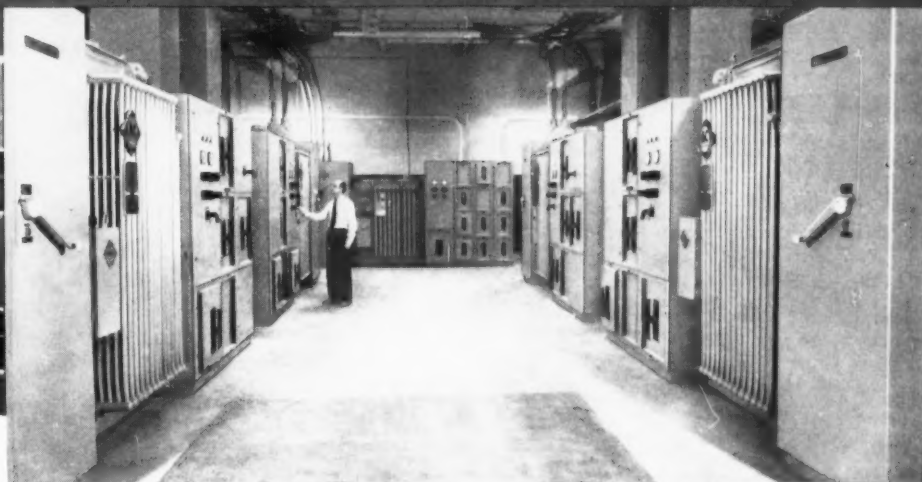
Allis-Chalmers primary and secondary substations and primary distribution equipment were selected for use throughout this modern distribution system to meet the requirements for flexibility and reliability. Each of 29 substation transformers used in this project is equipped with provisions for future forced-air cooling — thus permitting load growth to 54,000 kva.

You will find the answer to almost any plant power need in Allis-Chalmers equipment. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



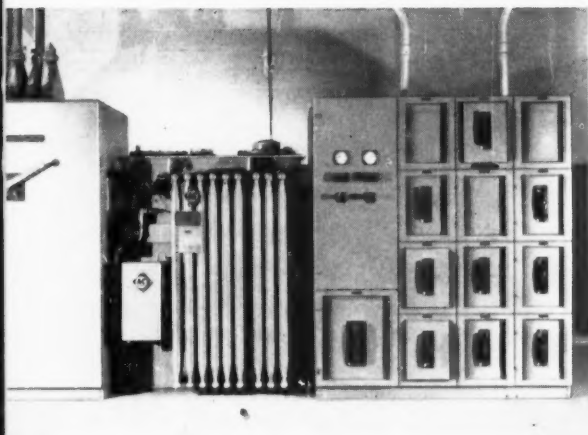
All the auxiliary switchgear for a complete power plant—and all of it on a common aisle! This unusual installation includes, from left to right, 480-volt, 2400-volt substations and 13.8-kv switchgear.

# **ALLIS-**

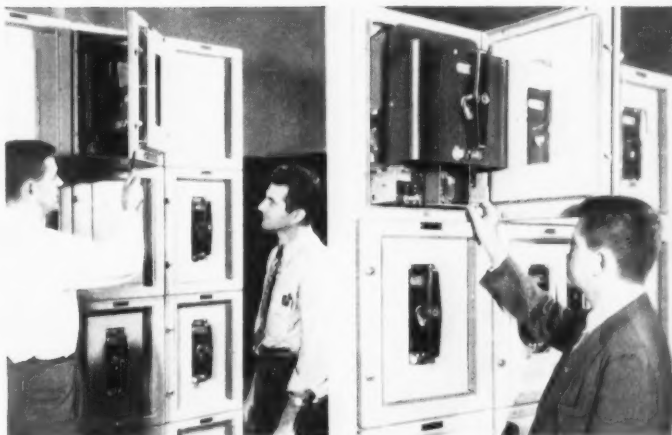


There are 9000 kva of unit substation equipment in this one room! This equipment was located close to the load center by placing it in a room directly above the production area it serves.

## Allis-Chalmers Switchgear



An Allis-Chalmers *First*, the reversible door panel provides breaker storage inside cubicle. Note that three panels are reversed or protruding to provide the additional space in the cubicle for storage of disconnected breaker.



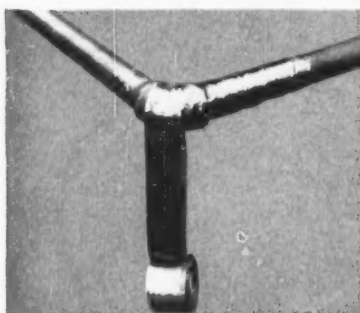
Breaker compartment door swung open showing depth of reversible door panel, eliminating need for extra storage space. Calibrated scales on trip adjusting knobs provide accuracy of settings, action, adjustment and indication.

# CHALMERS



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## Readers' Comment

research of this nature, however.

The Ann Arbor, Michigan area is a consulting engineering center; and I know of few consulting offices here that do not undertake independent research with their own resources. Some of this research is even of a pure research type with no immediate hope of economic return.

What is true of consulting firms here is doubtless true of consulting firms country-wide; and so while I have no intention of detracting from Ebasco's fine effort, this type of thing is not unique. As a beautiful example I have only to mention Dr. Steinman's revolutionary development work on the suspension bridge which was entirely financed by himself.

Curtiss D. Bassett  
Consulting Engineer  
Ann Arbor, Michigan

### Prestressed Concrete Tanks

Sir:

The article by Mr. Arthur M. James, titled "Prestressed Concrete . . . Where Do We Stand?", in your October issue omitted reference to what we proudly believe was the major contribution to the development of prestressed concrete in this country.

This company, whose antecedents date from 1934, was the first to utilize prestressed concrete in the United States on a commercially noteworthy scale. The attempts of the founders of this company to apply prestressing techniques to circular, liquid-containing structures led to investigation of the phenomena of plastic flow and

### Hangar Heating Systems

Sir:

In your November issue, Airport Engineering Section, page 95, appears the text:

"Suspended units cost about 25 percent more than a comparable hot air system, and the heat tends to stratify."

It has been our experience and that of many of our customers that the above is not generally true when our overhead suspended heaters are used. These heaters project the warm air to the working level without expensive duct work. Therefore, when comparisons were made on an installed cost basis it was proved in many hangar installations that considerable savings resulted.

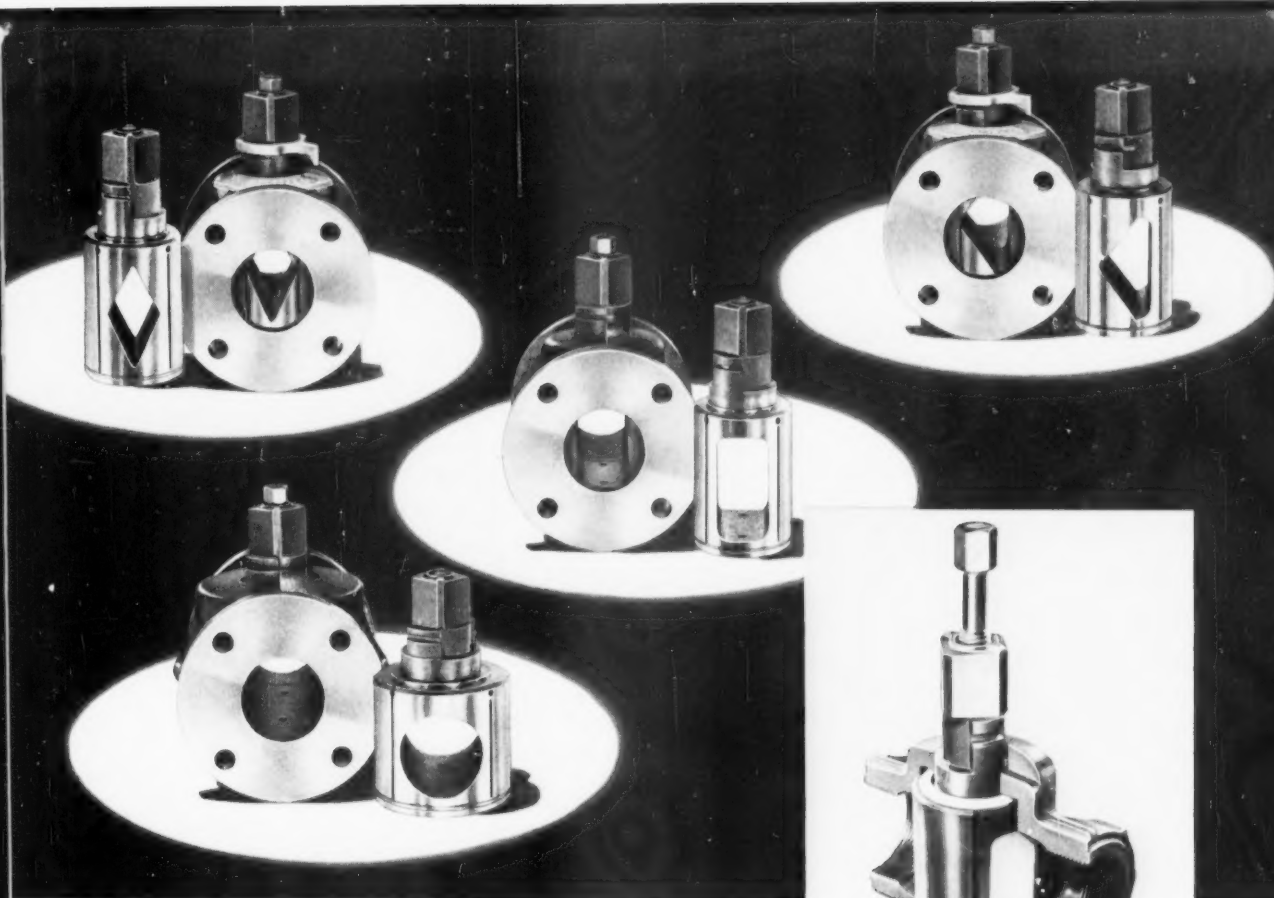
Further, numerous tests have shown that temperature differences between the floor level and the truss area were no more than a very few degrees.

F. P. Vultaggio  
Application Engineer  
L. J. Wing Mfg. Co.

### Research and the Consultant

Sir:

In regard to your comment "Research Responsibility" in the Readers' Guide of the December 1958 issue, I agree that Ebasco is to be complimented for their independent research. I can't agree that few consulting firms undertake



## **W-K-M's** *Creative Engineering* assures the dependable performance of **W-K-M's ACF Lubricated Plug Valves**

**L**ubricated plug valves are the work-horse valves of industry. They're versatile, they're economical, they're readily available.

But one lubricated plug valve is not "just as good as another!" The ACF Cylindrical Plug Valve has many advantages.

W-K-M's creative engineering has designed the ACF valve to give you longer life, greater efficiency, minimum maintenance. W-K-M production pays constant attention to the manufacturing details that spell the difference between a "pretty good valve" and the best you can use. W-K-M tests every ACF valve against requirements much beyond the use for which it is rated.

In short, W-K-M's creative engineering assures you *dependable performance* from every ACF Lubricated Plug Valve in your plant.

### **Advantages of ACF<sup>®</sup> Lubricated Plug Valves**

These versatile valves have full pipe area openings. They provide through-conduit flow with minimum turbulence and minimum pressure drop.

They can be installed in any position. They can be serviced quickly.

They are safe against rupture while lubricating—excess lubricant escapes visibly to the atmosphere around the neck of the plug; this eliminates build-up of lubricant pressure, prevents lubricant from escaping into the line.

Lubricant protects against corrosion.

Available in semi-steel, Ni-resist, carbon steel, bronze and aluminum.

WRITE FOR CATALOG 400

# **W-K-M**

**DIVISION OF ACF INDUSTRIES**  
INCORPORATED  
P. O. BOX 2117, HOUSTON, TEXAS

5821

shrinkage. The work of Mr. J. M. Crom, a founder of Preload and a pioneer in this important field, paralleled similar investigations in Europe, the combination of which ultimately resulted in the birth of practical methods of prestressed concrete design and construction.

No other type of structure lends itself to the principles of prestressed concrete construction so well as a tank. The investigation of Mr. Crom led to the invention of equipment capable of applying high tensile wire under predetermined tension around a concrete cylinder with the result that a compressive force is induced in the concrete that equals or slightly exceeds the tensile forces induced by the load of the contents. This is certainly a classic application of the prestressing principle and one which has been widely utilized since World War II. The fact that it is purely American in origin, and the only prestressing method exported from the United States, makes it in our

opinion a development worthy of mention in any article on prestressed concrete.

Kenneth E. Dixon  
Vice President  
The Preload Co., Inc.

#### Favors Functional Groups

Sir:

Your editorial in the December issue containing your comments on NSPE and specifically the Consulting Engineers Functional Group is another of your provocative and interesting editorials.

Having discussed these specific items with you personally, I realize that we are all working toward the same goals and that your constructive criticisms are intended to promote the profession. However, many of our colleagues who do not know the background could be misled by your article.

In regard to your comments concerning the lack of positive programs sponsored by the Functional Groups, I believe that you are be-

ing unfair. I know that many of the programs attended by you have had discussions concerning rival consultant organizations; but in many such cases these discussions were provoked by your presence. The Ohio and Kansas groups, the oldest and most active groups, have several constructive programs related to public relations, ethics, legislation — all within the province of a professional organization.

You propose to have two organizations for consultants, the functional group for professional discussions and a separate association for business activities. The experience of our Consulting Engineers Functional Group in Ohio well indicates that we can provide all the services required by consultants. The energies required to organize, provide leadership, and actively promote two organizations for these two fields of activities that overlap and overlock are not justified.

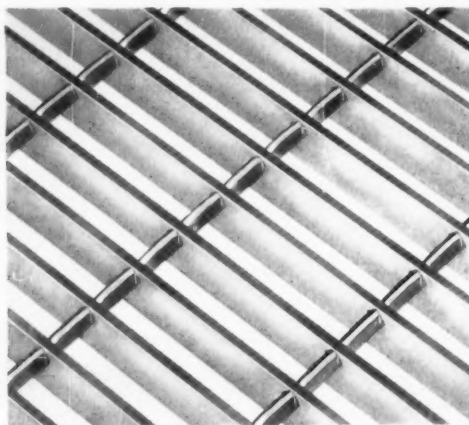
In regard to your remarks concerning friction between the Ohio Functional Group and the Cincinnati Association of Engineers, neither of these groups has expended one iota of energy "in-fighting" the other. The leaders of the Cincinnati group are respected friends of the Ohio Society. These sincere men believe that the association offers the better opportunity and are endeavoring to show that this is true. Both groups believe that some method of cooperation can be worked out so that the Ohio groups can function together. Your comments regarding "in-fighting" are unfortunate and could be detrimental to all Ohio consultants.

As long as any group has the active support of the local consultants and meets the needs of the consultants as the Ohio Functional Group is doing and can do, it is worth while and should receive the support of a magazine that purports to represent all consulting engineers.

Harold A. Kelley, Chairman  
Consulting Engineers of Ohio  
A Functional Group of OSPE

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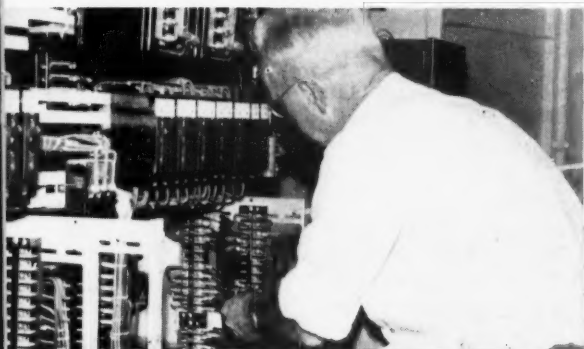


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**GRATING DIVISION**

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**ANACONDA TYPE ANW-RUBBER-INSULATED CONTROL CABLE.** Peak reliability, outstanding heat resistance. Cable is also highly resistant to moisture, acids, alkalis, other chemicals. Unusual overload capacity and long-aging characteristics. Individual conductor covering and over-all jacket of neoprene.



**ANACONDA BUTYL-INSULATED CONTROL CABLE.** Ozone-resistant control cable. Individual conductor covering and over-all jacket of neoprene provide maximum insurance against moisture, mechanical injury. High-quality product with outstanding performance record.



**ANACONDA THERMOPLASTIC CONTROL CABLE.** Multiple-use: aerially, in conduit, underground in ducts, direct burial in earth. Available with polyethylene (600 or 1000 volts) or Densheath® vinyl resin (600 volts) insulation and Densheath over-all jacket. Densheath jackets over polyethylene-insulated conductors on request.



**ANACONDA TYPE PND CONTROL CABLE.** For general-purpose use where space is limited. Allows installation of a 12-conductor cable in conduit carrying a 6 or 7. Individual conductor covering of abrasion-, oil-, gasoline-resistant nylon. Over-all Densheath jacket.

## APPLICATION CHART FOR ANACONDA CONTROL CABLE

TYPE AND VOLTAGE RATING	CHARACTERISTICS	GENERAL APPLICATIONS	INSTALLATION METHODS
RUBBER—Insulated Control Cables			
Rubber-Insulated 600-Volts	Excellent moisture, heat resistance. Long-aging.	General-purpose and station control requirements.	Installed aerially, in conduit, underground in ducts—or buried directly in earth.
Ozone-Resistant Rubber—Insulated 600-Volts	Ozone-resistant. Proved moisture resistance, heat stability. Long-aging.		
THERMOPLASTIC—Insulated Control Cables			
Polyethylene-Insulated 600-Volts	Excellent moisture and chemical resistance. Highly resistant to electroendosmosis. Long-lived.	General-purpose control requirements.	Installed aerially, in conduit, underground in ducts—or buried directly in earth.
DENSHEATH®-Insulated 600-Volts	Thermoplastic cable. Excellent moisture and chemical resistance. Long-aging.		
Anaconda Type PND® Polyethylene-Insulated-Nylon Conductor Cover 600-Volts**	Dependable chemical and abrasion resistance. Small diameter. Long-aging.	General-purpose control requirements where space is a limiting factor.	Installed aerially, in conduit or underground in ducts.
Polyethylene-Insulated 1000-Volts	Peak moisture and chemical resistance. Heavy insulation thickness. Long-aging.	Station control requirements.	Installed aerially, in conduit, underground in ducts—or buried directly in earth.

\*IPCEA voltage rating is 300 volts.

®Trademark.

Lead sheaths furnished on rubber-insulated control cables if requested.

Interlocked armor available for all types of control cable.

\*\*IPCEA voltage rating is 300 volts.

®Trademark.

Lead sheaths furnished on rubber-insulated control cables if requested.

Interlocked armor available for all types of control cable.

For full information on any of Anaconda's complete line of control cables—including cables engineered for more specialized control requirements—see your Anaconda distributor or the Man from Anaconda. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.



SEE THE MAN FROM **ANACONDA®**  
FOR **CONTROL CABLE**

# *Curtis*

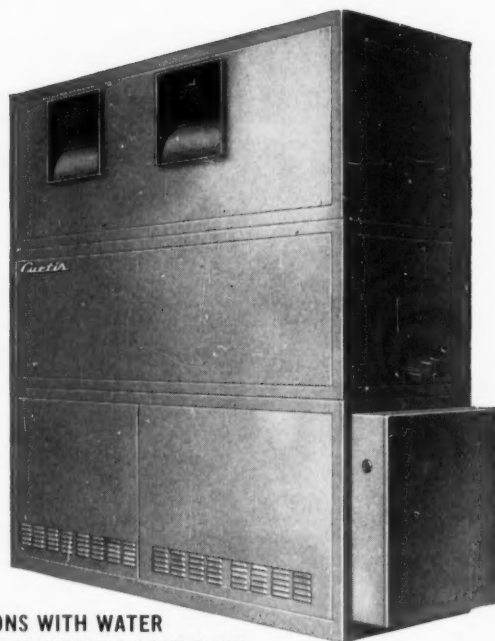
## PACKAGED AIR CONDITIONING

**INSTALLATION EASIER:** Line assembled at the factory—eliminates expensive field labor.

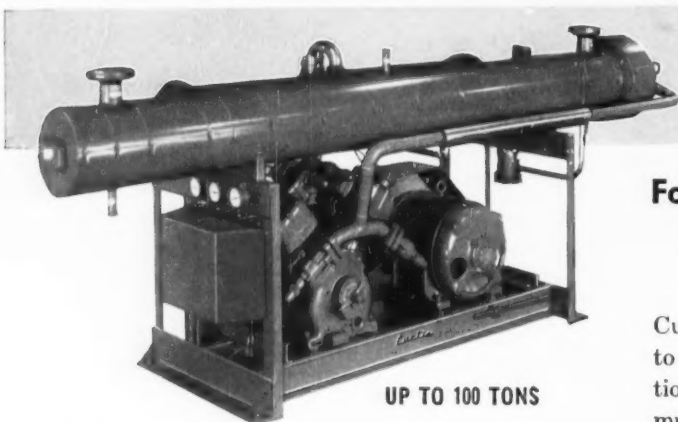
**PERFORMANCE KNOWN:** Curtis units are run-in at the factory and guaranteed to deliver their rated tonnage. Assures a **BALANCED SYSTEM**.

**SUPERIOR EQUIPMENT:** Long life, quiet, trouble free, economical operation.

**DELIVERY ON TIME:** Curtis can meet your delivery requirements, a decided advantage over multiple supplier delivery promises!



UP TO 100 TONS WITH WATER  
COOLED OR EVAPORATIVE CONDENSER



UP TO 100 TONS

## PACKAGED LIQUID CHILLERS

**For Air Conditioning  
Process Cooling  
Refrigeration**

Curtis packaged liquid chiller lends itself to a widely diversified field of applications—air conditioning, refrigeration and a multitude of process cooling procedures. Available in capacities up to 100 tons.

**REMEMBER, you can count on**

# *Curtis*

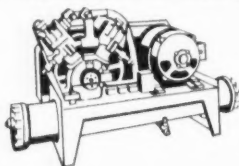
OUR 104TH YEAR

**MANUFACTURING COMPANY • REFRIGERATION DIVISION**

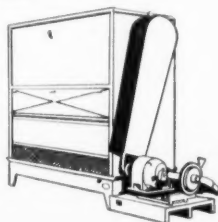
1991 Kienlen Ave., St. Louis 20, Mo.



Air Cooled Air Conditioning Units,  
3-5-7½ tons. Residential and  
commercial application.



Condensing Units  
up to 100 tons.



Cooling towers and evaporating  
condensers, air handling units  
to match.

**VISIT BOOTH 802**

Heating & Air Conditioning  
Exposition  
**PHILADELPHIA**  
Jan. 26-29, 1959

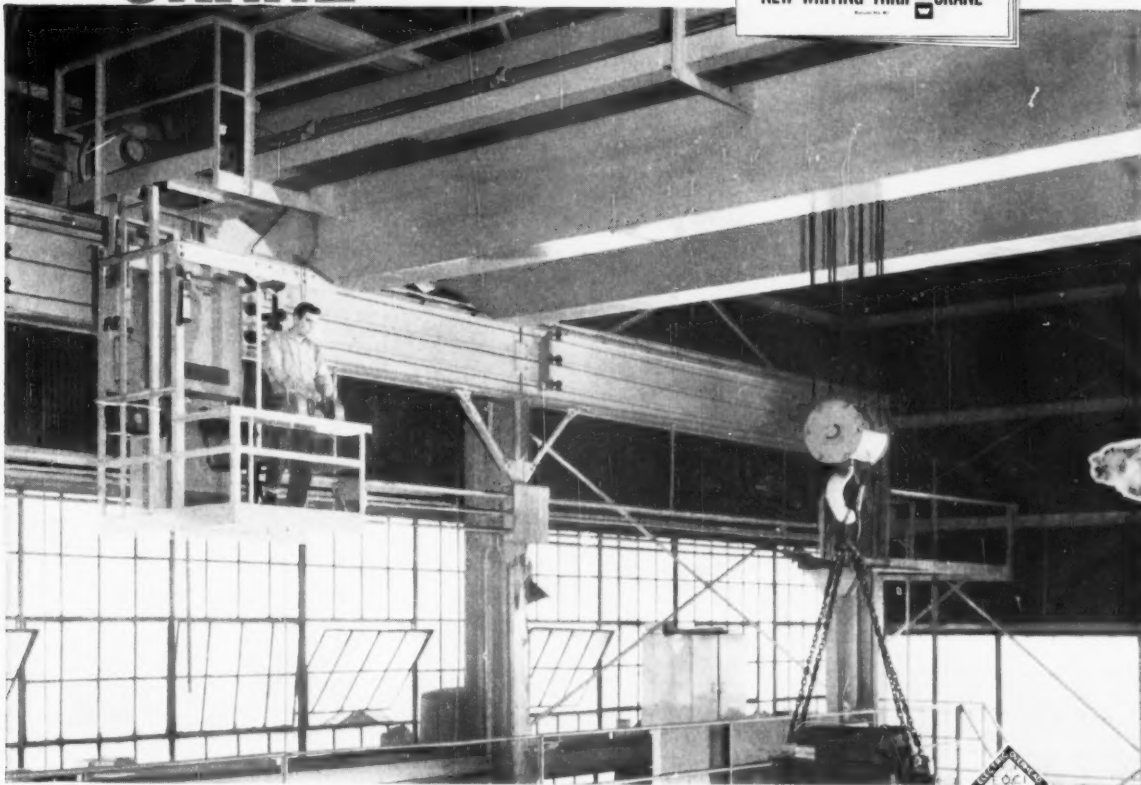
See our newly designed  
packaged air conditioners  
and liquid chillers

# NEW THRIF-T CRANE

SEND FOR NEW BOOKLET  
Bulletin 91 giving detailed information.

Keep  
your  
capital  
investment  
down

with the  
NEW WHITING THRIF-T CRANE



## An Answer to Plant Modernization

Whiting's new Thrif-T Crane is slated to spark a trend in plant modernization. It's a husky crane. It has plenty of stamina to do big jobs with the speed demanded by today's production schedules and cost levels. Yet, it costs much less than you'd expect! Pre-

engineering, mass-produced parts... and a host of exciting new design developments enable new Thrif-T Crane to provide big-crane performance at small-crane cost. Whiting Corporation, 15620 Lathrop Avenue, Harvey, Illinois.

87 OF AMERICA'S "FIRST HUNDRED" CORPORATIONS ARE WHITING CUSTOMERS

# WHITING

75th year



MANUFACTURERS OF CRANES; TRAMBEAM HANDLING SYSTEMS; TRACKMOBILES; FOUNDRY, RAILROAD, AND CHEMICAL PROCESSING EQUIPMENT.

# Long Span **M-DECK** Produces



Interior View of The Satellite Bowl — a new bowling center in Inkster, Michigan. In this unique structure, the ceiling effect was achieved by utilizing Mahon M Deck to provide the Structural Roof Unit, the Finished Ceiling Material, and the Acoustical Treatment. Campbell Engineering Co., Architects and Engineers. Campbell Construction Co., General Contractors.



**Serving the Construction Industry Through Fabrication of Structural Steel, Steel Plate Components, and Building Products**

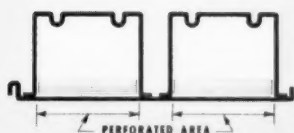
# Combined Roof and Acoustical Ceiling in Clear Span Roof Construction!

Roof is Supported by 126 Foot Laminated Wood Arches on  
23'-6" Centers; M-Deck Spans from Arch to Arch

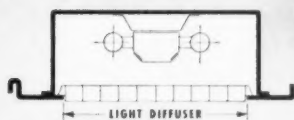
## MAHON Long Span M-DECK SECTIONS



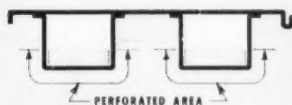
**SECTION M1-OB**  
OPEN BEAM DEPTH 3", 4½", 6" or 7½"



**SECTION M2SR (Acoustical)**  
CEL-BEAM DEPTH 3", 4½", 6" or 7½"



**SECTION M1T (Troffer)**  
DEPTH 6" or 7½"



**SECTION M2 (Acoustical)**  
CEL-BEAM DEPTH 1½", 3", 4½", 6 or 7½"

## ☆ OTHER MAHON BUILDING PRODUCTS and SERVICES:

- M-Floors (Electrified Cellular Steel Sub-Floors)
- Insulated Metal Curtain Walls
- Underwriters' Rated Metalclad Fire Walls
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- Steel Roof Deck
- Permanent Concrete Floor Forms
- Acoustical and Troffer Forms
- Acoustical Metal Walls and Partitions
- Acoustical Metal Ceilings
- Structural Steel—Fabrication and Erection
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☆ For INFORMATION See SWEET'S FILES  
or Write for Catalogues

At Left: Cross Section of Long Span M-Deck  
Combined Roof-Ceiling with Troffer Lighting.

THE R. C. MAHON COMPANY • Detroit 34, Michigan  
Sales-Engineering Offices in Detroit, New York and Chicago  
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of Steel and Aluminum

# MAHON



### Portrait of a Consultant

# The Readers' Guide

Every year we try to include in the January issue a survey of some important aspect of private practice. In the past we had been limited to some extent by the physical task of assembling data taken from questionnaires and presenting the facts in a way that had statistical meaning while still meeting our deadline. This year we have been aided by our battery of punch card equipment that not only sorts and counts but performs complicated calculations quickly and accurately. With this help we would have had no trouble in getting together data to the extent presented in past years, but the availability of the calculating machinery made possible so many interesting and important figures that we now find ourselves limited not by time but by space. We have decided, therefore, to turn our January survey into a series of statistical articles, each complete in itself but part of a major study that will appear from time to time all through the year. This first article sets the stage and introduces the characters. It gives a rather clear picture of the typical firm of consulting engineers — its size, the composition of the staff, the branches of engineering represented, and the type of work undertaken. This first study goes on to show the percentage of the staff's time devoted to preliminary, design, and supervision phases of projects and the time given to independent engineering research not assignable to any project. Future articles will present data on fees, finance, and other aspects of firm operation. Then, the answers will be further broken down to compare data from the various branches — civil, mechanical, electrical, structural — and according to geographical location and firm size. When all these studies have been published, the consulting engineer should know much more about the organization and operation of professional firms than he knows now.

It also has been our practice each January to publish an economic forecast by an outstanding economist. We are particularly fortunate this year in having secured an economic study by Dr. Jules Backman. Dr. Backman is highly respected in his field, and he is especially well known for his familiarity with the construction field. If he is right in his forecast, consulting engineers in most branches of the profession can look forward to a favorable financial situation during 1959. To find out exactly the way Dr. Backman sees the economic outlook, read the article starting on page 94.

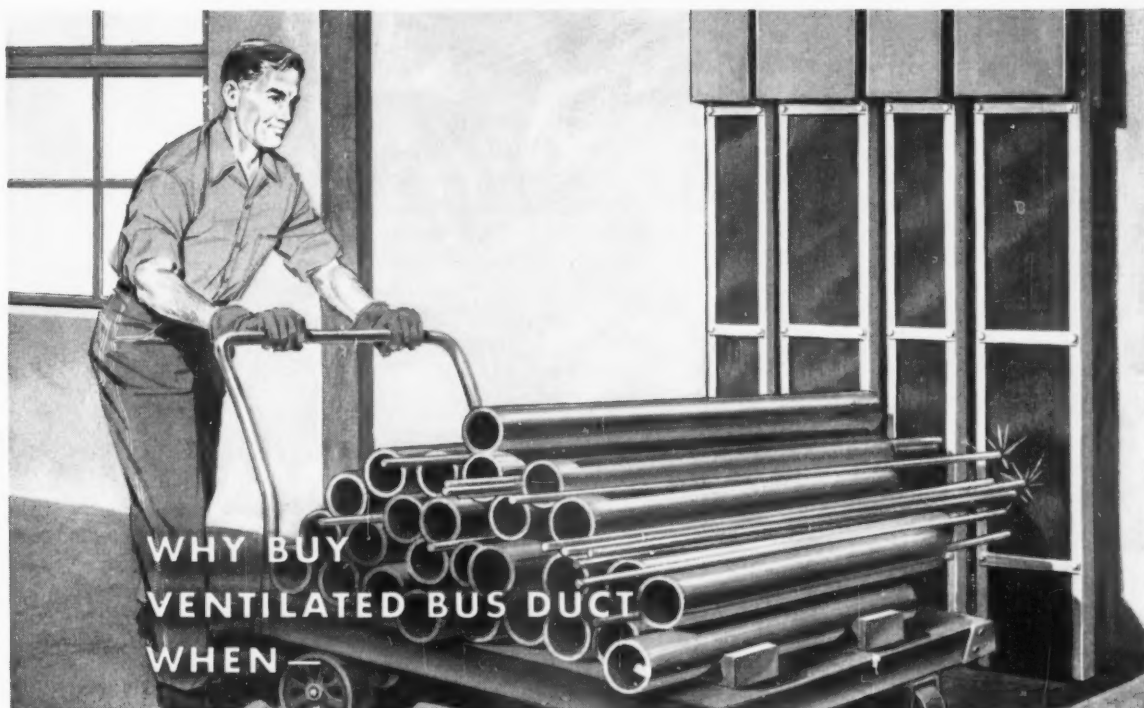
### A Case History

So far as timing is concerned, we were lucky in getting the article "Organization Problems in a Consulting Firm," from David L. Narver, Jr., of Holmes & Narver, just in time to get it in this issue where it fits excellently with the start of our serial survey on Organization and Operation. Here, in Narver's article, we have a case history of good organization methods applied to a consulting firm. It shows the small and medium size firm what new problems they can expect as they gradually grow to be large firms. Narver's article starts on page 106.

There have been important changes in Professional Liability policies in the past year. Competition among insurance firms and the additional experience records have made possible the broadening of coverage and the reduction of some premiums. Helen Keller, an independent insurance broker of San Francisco, has had a great deal of experience with the errors and omissions policies of all of the three companies offering them, and in her article "A Careful Comparison of Professional Liability Policies," starting on page 120, she gives the consulting engineer a good idea of what each policy offers. Every engineer in private practice, whether his firm now carries a policy or not, will find that Helen Keller offers much practical advice.

### Looking at The Year Ahead

### Errors and Omissions



## Square D TOTALLY ENCLOSED Duct\* is SAFER—and costs no more

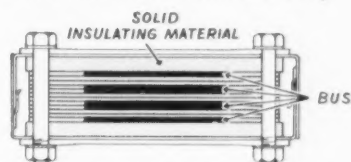
\*(low impedance)

• Ventilated bus duct may be as vulnerable as it looks. In fact, Paragraph 3644 of the National Electrical Code prohibits its use in certain areas by specifying:

"Busways may extend vertically through dry floors if totally enclosed (unventilated) where passing through and for a minimum distance of six feet above the floor to provide adequate protection from mechanical injury."

All Square D low-impedance duct is totally enclosed! It has no ventilation holes open to falling objects or dust. It mounts in any position without de-rating. Doesn't it make sense, when buying low-impedance duct, to specify a product that's safer? Square D totally enclosed low-impedance duct costs no more—why settle for less!

### Here's Why Square D's EXCLUSIVE Design makes ventilation unnecessary



The entire space within the duct and between the bus bars is filled with a solid insulating material which conducts the heat to the surface. There are no dead air spaces inside the duct. Square D totally enclosed low-impedance duct is listed with Underwriters' Laboratories and meets U/L requirements for temperature rise in any mounting position.



EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT... NOW A PART OF THE SQUARE D LINE

# SQUARE D COMPANY

Every consulting engineer eventually has to face the fact that there is not enough storage space for drawings. The usual solution is to rent an old loft in a low rent district and store the older drawings and specifications there, thinking that no call will come for the material sentenced to this distant and dusty Siberia. Then, for no logical reason, anything in cold storage suddenly becomes the most referred to material in the office, and help must be enlisted to carry it back and forth. There is a better solution. Charles George Schneider, of Ford, Bacon and Davis, tells how his firm has put all drawings and specifications on microfilm so that material that formerly occupied many thousands of feet of floor space now is neatly filed in a few cabinets. This is an idea not only applicable to large firms but even to the small consulting offices that would like to take all the records now stored in a good size room and put them in a small box. Schneider's article, "We Put Our Records & Drawings on Microfilm," starts on page 114.

### Drawings on Film

### Report From Africa

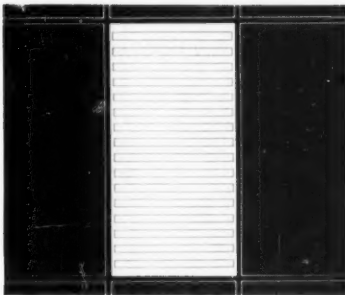
Our correspondent in South Africa, Peter Holz, comes through this month with an unusually interesting report on private practice in the now-not-nearly-so-dark continent. He points out that Africa is dam conscious, with every country with a river currently in some stage of planning toward the development of hydro-electric stations. This is going to be a blessing to the people, greatly raising their standard of living, but it will be a bit hard on some of the lions (they cannot swim, we were surprised to learn). Some way is going to have to be found to rescue them from islands in the man-made lakes behind the dams. For more on this, see Holz' report starting on page 112.

Primarily for aesthetic reasons, there has been resistance to the idea of using sewage plant effluent as a source of water. A few industries have been willing to pioneer, however, and results have been excellent. Perhaps "pioneer" is the wrong word unless one is speaking strictly of this country, for in Europe the reuse of sewage plant effluent is rather common. David Levy and Vincent J. Calise, authors of the article, "Fresh Water From Sewage," starting on page 100, point out that properly treated effluent may be superior to some natural streams now being used as a source of both municipal and industrial water. And with water becoming more and more scarce in some parts of the country, it is time we got over our squeamishness and recognized that water is water whatever its source, and after proper treatment there is no difference between the water from a sewage plant and that from a fresh mountain spring. Anyhow that is the way Levy and Calise see it, and they put up a well documented argument.

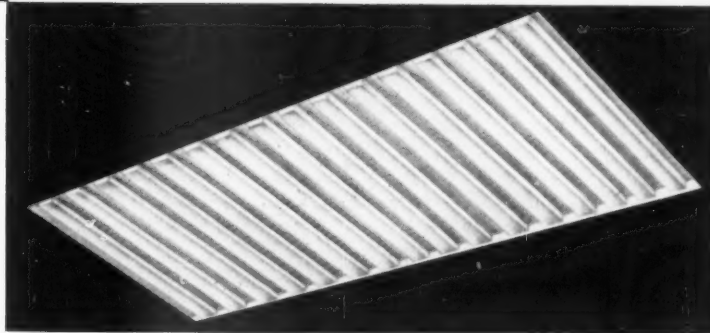
### Fresh Water From Sewage

### Advertising to Consultants

CONSULTING ENGINEER'S Committee of One-Hundred is made up of distinguished engineers in private practice from all branches of engineering and from all parts of the country. From time to time, we send these men topics for their study and discussion. The last topic sent them asked about advertising done by manufacturers and suppliers and directed at consulting engineers. The Committee was asked to give its opinions concerning the most effective approach, the right kind of copy and illustration, and the ways in which advertising can get its message to the consulting engineer. As always in the past when a topic has been put before them, the Committee responded excellently and in considerable detail. On the basis of the comments received, we prepared a summary report. This report has been sent to industrial firms who advertise to consultants, and comments from many of these manufacturers indicate that the advice is good and will be put to use. We are not publishing the summary report in CONSULTING ENGINEER, for we feel that this is the kind of information that can be used by those who write advertising for consultants rather than by consultants themselves. But we have plenty of the reports, and we will send a copy to any consulting engineer who is interested in seeing what the Committee of One-Hundred has to say about "How to Prepare Advertising for Consulting Engineers."



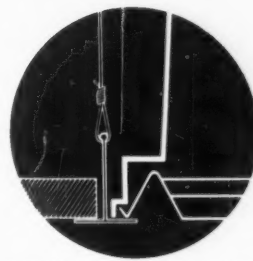
nothing but pure light!



Sometimes the difference in construction between various troffers is not readily apparent. But the difference in appearance after installation is always seen. Lightolier's new 2' x 4' modular troffers provide a clean panel of light that fills the entire opening between the structural members of suspended ceilings. No bulky steel frames, no exposed screws. Carefully engineered details like neat-fitting joints, frameless diffusers and hidden hinges make the decisive difference. Lightolier's Strialux, Domex and Optiplex diffusers meet most design or budget requirements. For a 120 PAGE CATALOG-BINDER detailing Lightolier's wide range of architectural lighting, write Dept. CE-19

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ARCHITECTURAL LIGHTING • RESIDENTIAL FIXTURES • PORTABLE LAMPS  
MAIN OFFICE AND FACTORY: JERSEY CITY 5, NEW JERSEY

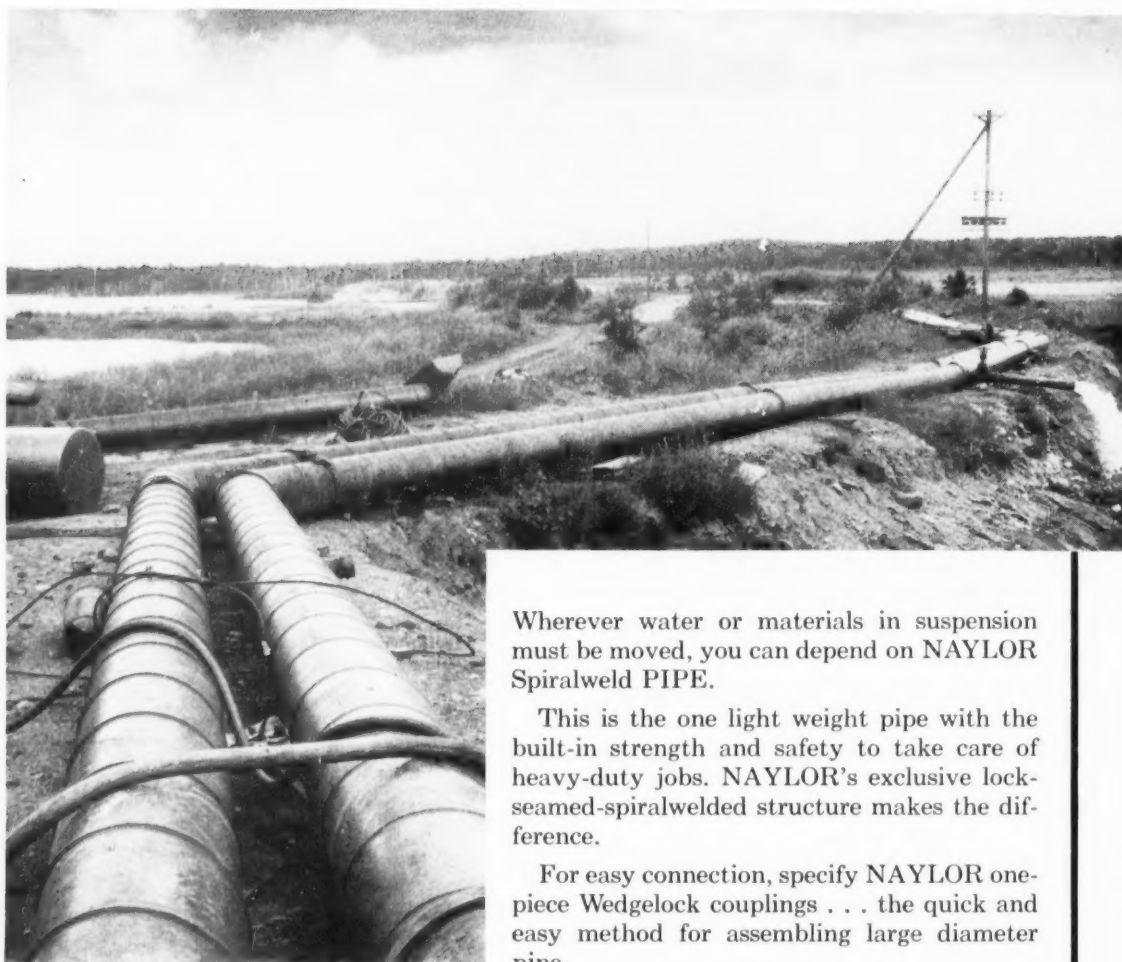


EXPOSED GRID CEILING DETAIL

See all the newest Lightolier designs at these authorized distributors:

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Bend:</i> Englewood Elec. Sup. Co. <b>IOWA</b> <i>Des Moines:</i> Weston Lighting Co. <b>KANSAS</b> <i>Kansas City:</i> W. T. Foley Elec. Co. <b>KENTUCKY</b> <i>Paducah:</i> Ohio Valley Sup. <b>LOUISIANA</b> <i>Baton Rouge:</i> Electrical Wholesalers <i>New Orleans:</i> Interstate Elec. Co. <b>MAINE</b> <i>Bangor:</i> Standard Elec. Co. <i>Portland:</i> Holmes Elec. Supply Co. <b>MARYLAND</b> <i>Baltimore:</i> Excella Public Serv. Corp. <b>MASSACHUSETTS</b> <i>Boston:</i> Mass. Gas & Elec. Light Co. Henry L. Wolfers Inc. <i>Fitchburg:</i> Service Elec. Sup. Co. <i>Pittsfield:</i> Cart Supply <i>Springfield:</i> Eastern Elec. Sup. <i>Worcester:</i> Atlantic Elec. Sup. Benjamin Elec. Sup.	<b>MICHIGAN</b> <i>Detroit:</i> Madison Elec. Co. Michigan Chandelier Co. <i>Flint:</i> Royalite Co. <i>Grand Rapids:</i> Purchase Elec. Sup. Co. <i>Pontiac:</i> Standard Elec. Co. <i>Saginaw:</i> Standard Elec. <b>MINNESOTA</b> <i>Duluth:</i> Northern Elec. Sup. Co. <i>Minneapolis:</i> Charles A. Anderson & Co. <i>Northland:</i> Elec. Sup. Co. <i>St. Paul:</i> Lax Elec. Co. <b>MISSOURI</b> <i>St. Louis:</i> M. K. Clark <b>NEBRASKA</b> <i>Omaha:</i> Electric Fix. & Sup. Co. <b>NEVADA</b> <i>Reno:</i> Western Elec. Dist. Co. <b>NEW HAMPSHIRE</b> <i>Portsmouth:</i> Mass. Gas & Elec. Light Co. <b>NEW JERSEY</b> <i>Atlantic City:</i> Franklin Elec. Sup. Co. <i>Camden:</i> Camden Elec. Fix. Co. <b>NEW MEXICO</b> <i>Albuquerque:</i> Albuquerque Dist. Co. <b>NEW YORK</b> <i>Albany:</i> Havens Elec. Co. Inc. <i>Hinghamton:</i> Freije Elec. Sup. Co. <i>Buffalo:</i> Buffalo Incan Light Co. Inc.	<i>Niagara Falls:</i> Nyssen Sup. Co. <i>Poughkeepsie:</i> Electra Sup. Co. <i>Rochester:</i> Rome Electric Sup. Co. <i>Syracuse:</i> Superior Elec. <b>NORTH CAROLINA</b> <i>Charlotte:</i> Independent Elec. Sup. <i>Durham:</i> Noland Co. <i>Greensboro:</i> Elec. Sup. & Equip. Co. <i>Kinston:</i> Kinston Elec. <i>Winston-Salem:</i> Noland Co. <b>OHIO</b> <i>Akron:</i> The Sacks Elec. Sup. Co. <i>Canton:</i> The Electric Sales <i>Cincinnati:</i> B. & B. Elec. <i>F. D. Lawrence:</i> Electric Co. <i>Cleveland:</i> H. Leff Electric <i>Columbus:</i> Eggee Elec. Co. <i>The Loeb:</i> Elec. Co. <i>Dayton:</i> Duellman Elec. Co. <i>Toledo:</i> Gross Elec. <i>Youngstown:</i> Mart Industries <b>OKLAHOMA</b> <i>Tulsa:</i> Lawson Elec. Co. <b>PENNSYLVANIA</b> <i>Allentown:</i> Coleman Elec. Co. <i>Erie:</i> Kraus Elec. Co. <i>Harrisburg:</i> Fluorescent Sup. Co. <i>Hazleton:</i> Power Elec. Co. Inc.	<i>New Castle:</i> Midwestern Elec. Co. <b>PHILADELPHIA</b> <i>Ace Lighting:</i> Fix. Co. <i>Gold Seal:</i> Elec. Sup. Co. <i>Sylvan:</i> Elec. Fix. Co. <b>PITTSBURGH</b> <i>Allied:</i> Elec. Sup. Co. <i>Argo-Lite:</i> Studios <i>Douglas-Hill:</i> Elec. Co. <i>Wally:</i> Elec. Sup. Co. <i>Reading:</i> Coleman Elec. Co. <i>Syracuse:</i> Lewis & Reif <i>Wilkes-Barre:</i> Anthracite Elec. Sup. Co. <b>RHODE ISLAND</b> <i>Pawtucket:</i> Major Elec. Sup. 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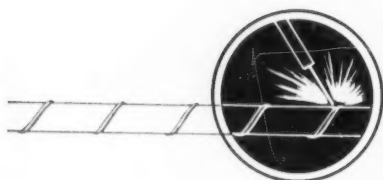


Wherever water or materials in suspension must be moved, you can depend on NAYLOR Spiralweld PIPE.

This is the one light weight pipe with the built-in strength and safety to take care of heavy-duty jobs. NAYLOR's exclusive lock-seamed-spiralwelded structure makes the difference.

For easy connection, specify NAYLOR one-piece Wedgelock couplings . . . the quick and easy method for assembling large diameter pipe.

For complete details in capsule form, write for Condensed Catalog No. 59.

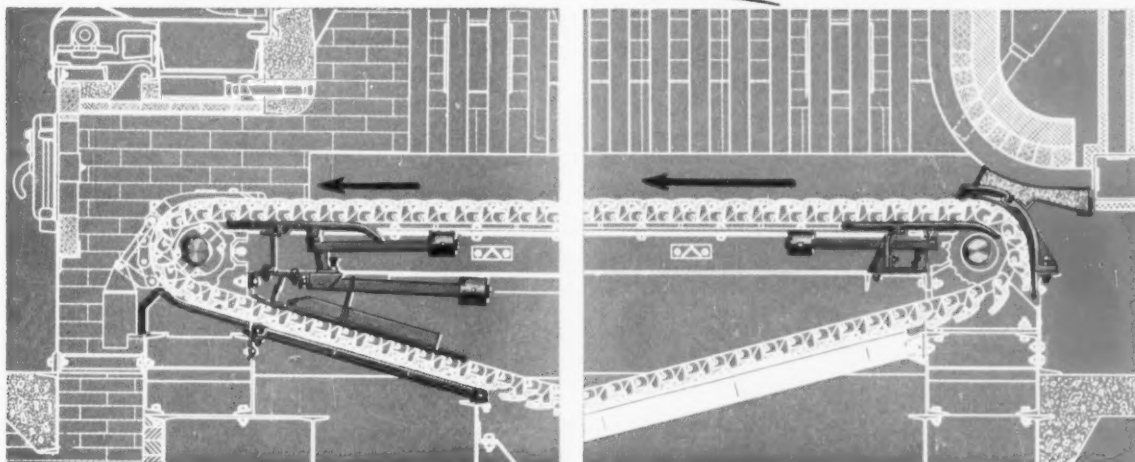


## NAYLOR PIPE *Company*

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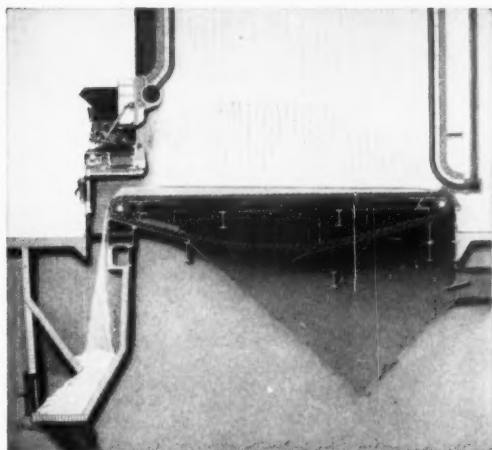
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# DOWN WITH EXCESS AIR!



Floating Front and Rear Grate Seals—A Detroit RotoGrate Exclusive.  
They decrease excess air.

## Automatic Air Seals Exclusive With Detroit RotoGrate Stokers Reduce Excess Air to 22% and Lower



Detroit RotoGrate Stoker — an advanced design spreader stoker with forward moving grates, for medium and large boilers. Burns all ranks of bituminous coals and lignites without special preparation . . . also many waste or refuse fuels, either alone or in combination with coal. Efficiency is high — maintenance low.

Many users reduce excess air to 22% or under, due to these free floating automatic front and rear seals with adjustable counterweights. They really seal, and stay sealed even after years of service. Air is directed to the active combustion zone. The result is increased combustion efficiency and economy.

The rear under-grate seal plate provides a quiet coking section which extends across the furnace . . . expedites the ignition of green fuel.

These and many other exclusive features of advanced design make Detroit Stokers your best buy. There is a type and size Detroit Stoker for any boiler capacity from 3,000 to 400,000 pounds steam per hour.

**DETROIT STOKERS COST LESS: COST = INITIAL INVESTMENT + UPKEEP + PRODUCTION LOSSES DUE TO EQUIPMENT OUTAGE. THE TOTAL IS LESS WITH DETROIT.**

**DETROIT STOKER  
COMPANY**

MAIN OFFICE AND WORKS

MONROE, MICHIGAN

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# SEVEN THAT SAVED...through



**PA.-N.J. TURNPIKE.** Big job, big responsibility. Flynn railing components throughout this huge Delaware River Bridge and its approaches (7½ miles in all) were delivered as promised, installed quickly.



**STONY CREEK, VA.** Small job, small budget. But the railing had to be attractive, easy to install, and permanent. Flynn aluminum railing and posts filled the bill perfectly, even to special railing-end design.



**HAMPTON ROADS, VA.** Flynn railing and posts arrive at the site on schedule to keep pace with other construction operations. No elaborate unloading or storage setup needed—weather can't hurt these parts.



**PHILADELPHIA-GLOUCESTER.** New Walt Whitman Bridge between Philadelphia and South New Jersey uses Flynn aluminum railing sections of the baluster type. Only two men are needed to install them.

# Flynn aluminum bridge railing

These seven recent installations of Flynn bridge railing help prove the versatility and economy of lightweight Flynn aluminum components. From the largest to the smallest job, Flynn railing, rail seats, castings, anchor bolts—all made from aluminum alloys of the highest quality—are delivered as specified and when needed. When it comes to railing on your next bridge or highway job—ask *Flynn first*.

## MICHAEL FLYNN MANUFACTURING COMPANY

Aluminum Division

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# FLYNN

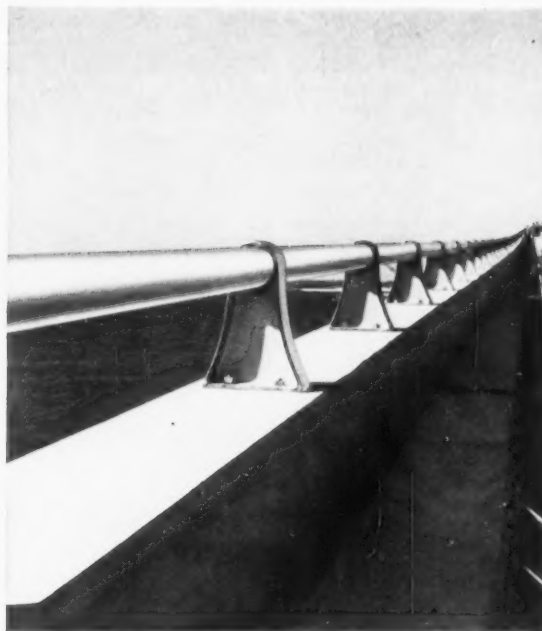
## EXTRUSIONS



**WILMINGTON, DEL.** This new Walnut Street draw-bridge in Wilmington has a combination of round and rectangular Flynn railings. Installation is made easier by precise fitting of bolt holes between parts.

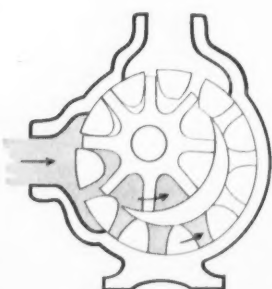


**McARTHUR CAUSEWAY, FLA.** Attractive Flynn railing and posts can be obtained in a wide variety of styles to fit any landscape, save design time and money, enhance the beauty of the surroundings.



**GARDEN STATE PARKWAY.** Beesley's Point bridge on the new north-south New Jersey artery, another large project where a few men, without cranes or lift trucks, did the whole Flynn installation job swiftly, economically.

# WHY are Viking rotary pumps BETTER?



# BECAUSE they are Mechanically Superior

The Viking "gear-within-a-gear" pumping principle makes liquids flow into and through the pump, changing direction ever so slightly until liquids are trapped. This action cuts turbulence, foaming, cavitation and power consumption to a minimum. As a result, liquids are delivered in a smooth, positive flow... free of aeration.

# TESTED

In test after test the superiority of Viking's pumping principle has been proved over other rotary pump action... and even more pronounced when handling fluids of 750 SSU and thicker. Learn the complete story on Viking rotary pumps. Send for free catalog

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Pump Company

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In Canada it's "ROTO-KING" pumps

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## The Legal Aspect

MELVIN NORD, P.E.

Consultant in Legal and Technical Problems  
Patent Attorney

### The Law of Real Property: Mineral Rights

ALTHOUGH we already have touched on mineral rights, this subject is of considerable importance in engineering practice and warrants more detailed treatment.

#### Profits

Mineral rights often are sold separately from the ownership of the land in which the minerals are located. The usual form of this transaction is called, in law, a profit (or a profit a' prendre), regardless of whether it is called by the parties a sale, lease, or license.

By definition, a profit is a power and privilege to acquire, through severance from the land, some substance that is included in the possession of the land. For example, it may be a right to take coal, minerals, oil, water, or ice from the land of another.

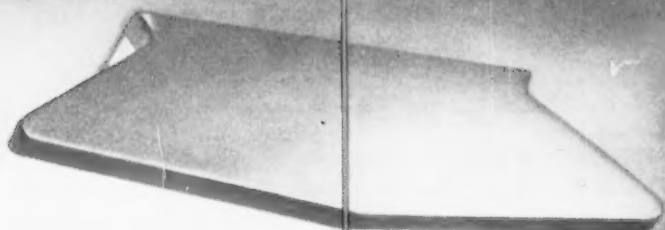
The owner of a profit is not the owner of the minerals but is the owner of the privilege of acquiring them. A profit is something like a license in that it permits a person to go on the land of another (which otherwise would be a trespass) and take something out of the land (which otherwise would be trespass in the nature of waste). It makes it permissible to do something which otherwise would be a wrong to the proprietor of the land. However, a profit is unlike a license in that it is not revokable at the will of the proprietor of the land. It is a real property right—a right

in the land of another, like an easement—and thus cannot be taken away unilaterally by the proprietor of the land.

#### Profits Appurtenant; Profits in Gross

A profit is always a real property right in the sense that it is a right in the land of another. That is to say, the burden of a profit inherently attaches to land. Land subject to such a burden is called a "servient" estate. When the land is sold the burden ordinarily stays with it so that the purchaser of land takes it subject to this burden, just as he would if the burden were a mortgage or a lien. However, if the profit was created by a deed, as it normally is, and this deed was not recorded prior to the subsequent sale of the land, the profit will be extinguished, provided the purchaser paid full value for the land and had no notice of the existence of the profit.

While the burden of a profit always is attached to land, the benefit may or may not be attached to other land. If the profit pertains to B's taking minerals from land A for use in conjunction with B's land, B's land is said to be the dominant estate, and the profit is said to be appurtenant to the dominant estate. Under these conditions, whoever own the dominant estate own the profit—the right to take minerals from the servient estate. However, the right cannot be exercised



## Something Really Different in Fluorescent Lighting

Sabre by Miller is a fresh, exciting approach to the design concept of on-the-ceiling fluorescent lighting. Here, shallow depth and sweeping lines blend to enhance the appearance of any interior. Styling, comfort and high efficiency meet the needs of modern stores and offices — commercial interiors of all kinds; schools, too.

Sabre's carefully engineered, one-piece wrap-around refractor of prismatic, crystal-clear plastic provides added sparkle, and excellent brightness control. Viewing is comfortable from all angles. Maintenance is easy.

And this unique combination of features comes at a truly popular price. Discover today, how the new Sabre can help solve your specific lighting design needs. Write Dept. 958-A, The Miller Company, Meriden, Conn. for complete catalog information, or contact your Miller Representative for a physical demonstration.



for a purpose unrelated to the use of the dominant estate.

On the other hand, if the taking of the minerals is not related to use on a specified dominant estate but is personal to the owner of the profit, it is said to be a profit in gross. It can be transferred by him to anyone else, unless the terms of the profit prohibit it.

#### Exclusive & Nonexclusive Profits

Normally a profit is not exclusive; it does not give the owner of the profit the exclusive right to take the minerals. The proprietor also has the right to take minerals from the land, or he may grant similar nonexclusive profits to others. There is nothing the owner of the profit can do about this except to take the minerals at an accelerated pace. He will not even be able to do that if his right is limited in some way.

If the deed creating the profit is silent on the question of whether it is exclusive or nonexclusive, it generally will be construed to be

nonexclusive, as there is a presumption against an exclusive grant. Thus, a nonexclusive profit is not much more than a matter of accommodation. If it is necessary to be assured of a constant supply of minerals, it is necessary to acquire an exclusive profit.

#### Apportionability of Profits

An exclusive profit may, in certain instances, be regarded as the full ownership of the minerals in place. Since the right is exclusive—since no one else has the right to take them—it is sometimes permissible to conclude that the owner of the exclusive profit is the owner of the minerals themselves.

Therefore, it follows that the owner of an exclusive profit can apportion his rights among several persons in any way he pleases, provided he stays within the terms of the profit. If it is an exclusive profit in gross, he generally can apportion it in any way he wishes. If it is an exclusive profit appurtenant, it will

be automatically apportioned if he divides the land and grants portions of it to several persons.

However, an exclusive profit appurtenant cannot be granted apart from the dominant estate. Any attempt to do so extinguishes the profit, since the grantee of the land has been expressly deprived of the profit and since the grantee of the profit cannot acquire the profit apart from the dominant estate. Since an exclusive profit appurtenant is limited in this way, it cannot properly be regarded as ownership of the minerals themselves.

It is thus only unlimited exclusive profits in gross that may be regarded as ownership of the minerals in place. Even this is true only if the minerals are of such a type as to be subject to ownership without actual reduction to possession. (This is not true of oil or gas but is limited to solids.)

Nonexclusive profits in gross are not apportionable. If the owner of such a profit could apportion his right, he obviously could greatly increase his rights beyond what actually was intended.

Nonexclusive profits appurtenant are, by their nature, normally apportionable in the same way as exclusive profits appurtenant. That is to say, if the owner of the dominant estate divides his land, the grantee of each portion normally gets his share of the profit. But there are some situations where this would clearly increase the use by the dominant estate beyond that anticipated and to the detriment of the servient estate. Where this is true, apportionment of the profit is not permitted. ▲▲

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## Torit dust collectors?



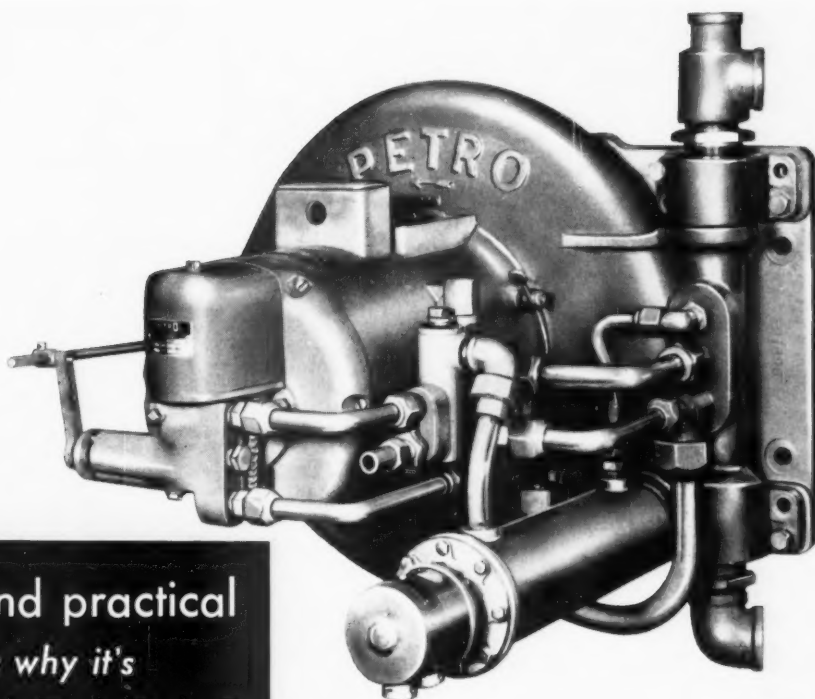
Clean machines hold close tolerances *better* and *up to 80% longer*. Result: a measurable saving in both the cost and frequency of servicing and maintenance work. You can protect your client's plant and equipment investment, help reduce potential production breakdowns, by specifying TORIT Dust Collectors. In the cabinet type (illustrated by cut-away drawing) filters are rated 99.99% efficient by weight on particles as small as 1/2 micron! Compact Torit high efficiency cyclone and cabinet type units are designed to save space, install anywhere. Your Torit representative will gladly give you dust collector specifications, performance charts, dimensional drawings and installation suggestions. Write:

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Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for \$1.00. Please write to: Reader Service Dept., CONSULTING ENGINEER, 217 Wayne St., St. Joseph, Mich.

# Petro HEAVY OIL BURNER



Simple and practical  
*that's why it's*  
**DEPENDABLE**

Residual oils are low cost fuels. They have higher heat value than light oils, and usually cost less per gallon. But in spite of their economy they are often avoided because they are considered difficult to handle and burn. A moderate change in temperature can change them from a fluid to a sluggish semi-solid.

These heavy oils (Nos. 5 and 6) are easily controlled and burned by the Petro system which is remarkably free from mechanical complexities.

1. A simple oil heater automatically warms the oil to a point where a common viscosity is reached. (Fuel oils approach this at a temperature of about 160 degrees).

2. An automatic valve passes the oil to the nozzle only when it is warm enough for accurate metering and instant ignition.

This is the basis of the Petro "Thermal Viscosity Principle." The Petro burner isn't fancy; it isn't temperamental; but it *stays on the job*.

In spite of its ruggedness, the Petro heavy oil burner is precision equipment which will operate efficiently with any type of automatic control system.

Petro oil burners have been the steady, reliable work horses in heavy oil firing for over 50 years. They have saved their owners untold thousands of dollars in low fuel and maintenance costs.

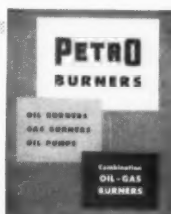
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Handling fluids at sub-zero temperatures or at super-heat — or any of the temperatures in between — is no problem if you install Powell valves. There is a Powell Dependable Valve to meet your most exacting flow-control requirements, no matter what the extremes of your needs.

The complete Powell line includes all types of valves in bronze, iron, steel and corrosion resistant metals and alloys, for pressures from 125 to more than 2500 pounds W.P. Consult your local distributor (there's one in most major cities) or write to:

**The Wm. Powell Company • Cincinnati 22, Ohio**

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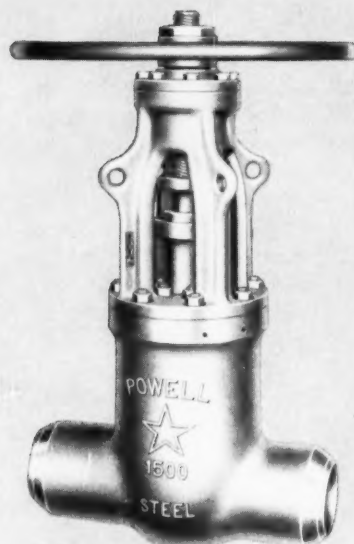


Fig. 11303 W. E.: Steel O. S. & Y. pressure seal gate valve for 1500 pounds W. P. at high temperatures. Powell pressure seal valves are available for working pressures from 600 through 2500 pounds.

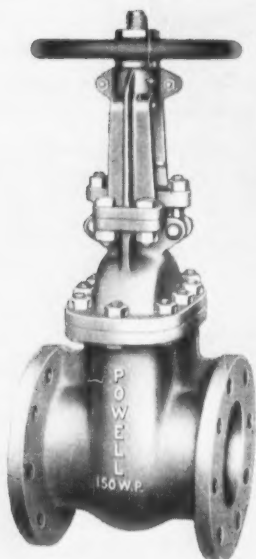


Fig. 86190: Steel union bonnet globe valve for 400 W.O.G. Designed for liquified petroleum gas service.



Fig. 2453G: Large 150 pound stainless steel O. S. & Y. gate valve for low temperature service. Can be furnished with interchangeable solid or double wedge disc.

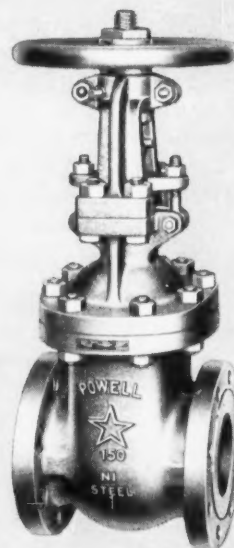
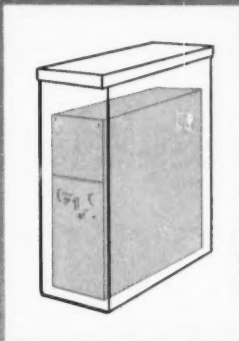
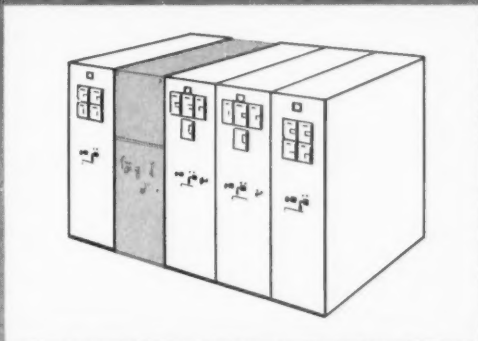


Fig. 1503 Mod.: 3½% Nickel-steel O. S. & Y. gate valve for low temperature service.

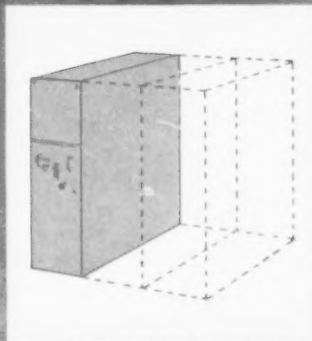
**POWELL...world's largest family of valves**



indoor or outdoor units



line-up with G-E Metal-clad



single or multiple units

## Installation versatility with General Electric **ROLLOUT** Switch and Fuse Equipment

You have a choice of construction types with General Electric's Rollout Switch and Fuse Equipment. It can be furnished to suit your installation needs—indoor or outdoor units, single or multiple units, or in line-up with General Electric Metal-clad.

Whichever type of construction you select you get improved protection, greater safety, and ease of maintenance and inspection. For

more information call your nearest General Electric Apparatus Sales Office or write for Bulletin GEA-6623, General Electric Co., Section H514-5, Schenectady, New York.

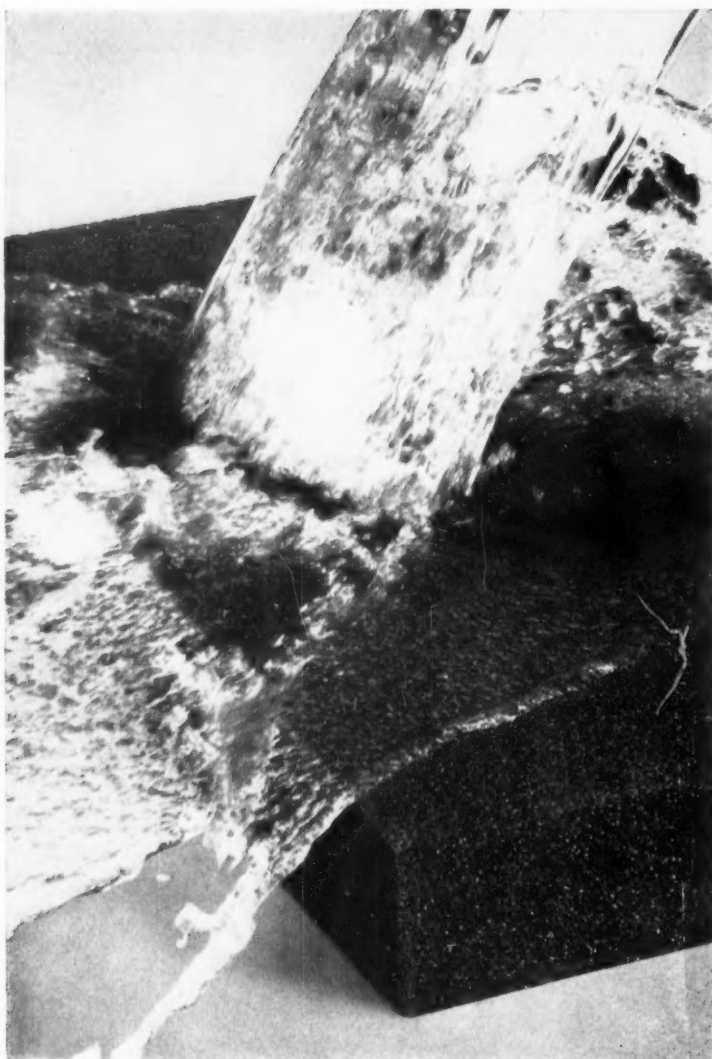
*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**



LINE-UP OF G-E ROLLOUT SWITCH AND FUSE EQUIPMENT with incoming Magne-blast circuit breaker now installed at Mission Valley Mills, New Braunfels, Texas. New equipment, rated 2.4 kv to 13.8 kv, is available in indoor or outdoor units, single or multiple units, or in line-up with Metal-clad switchgear.

# Only cellular glass insulation **FOAMGLAS® IS THE ONLY**



Whether you insulate building roofs and walls, piping or equipment, you can seldom anticipate *all* of the conditions to which your insulation will be exposed after installation. Humidity conditions change. Temperature control needs vary. Even the original use for insulated space or equipment may alter. That's why the ideal thermal insulation must give you a *combination* of key benefits . . . in order to serve satisfactorily under all possible conditions.

Most important, the ideal insulation must be impervious to water vapor as well as liquids—in order to insure constant performance under all humidity exposures. It should be proof against acids and acid vapors. It should be incombustible . . . dimensionally stable . . . impervious to vermin . . . strong enough for a variety of structural uses. Just one insulation—cellular glass—meets all of these qualifications.

FOAMGLAS is the only cellular glass insulation.

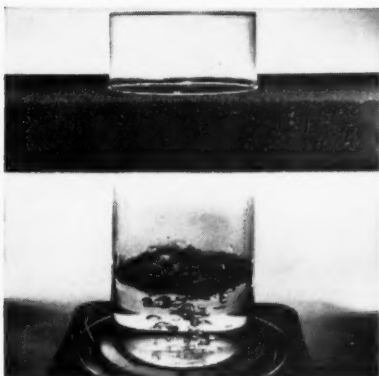
FOAMGLAS may well be the one satisfactory solution to all your insulating problems. For detailed literature, write—specifying your particular insulation requirements—to Pittsburgh Corning Corporation, Dept. R-19, One Gateway Center, Pittsburgh 22, Pennsylvania.

PC Glass Blocks and FOAMSIL® are other outstanding products of Pittsburgh Corning.

**P I T T S B U R G H**

# gives you all these key benefits

## CELLULAR GLASS INSULATION



**Moisture-proof!** The minute liquid or vapor enters an insulation, it begins to lose its insulating value because moisture conducts heat. FOAMGLAS, a material composed entirely of sealed glass cells, is completely impervious to all moisture. Its K factor—measure of insulating performance—never varies.



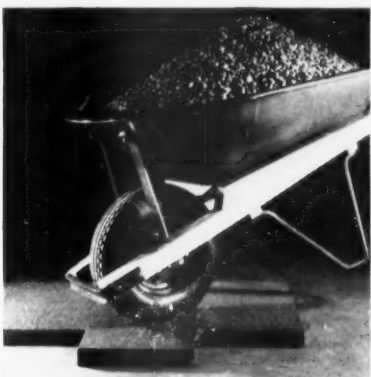
**Can't Burn!** Smoldering insulation in walls or roof of a building is a deadly fire hazard, hard to detect, difficult to control once detected. FOAMGLAS eliminates this hazard because it is the only insulation composed entirely of incombustible glass. This may even mean lower fire insurance rates in some cases.



**Dimensionally Stable!** Most insulations tend to warp, swell, shrink or slump after they are installed. This causes open joints in the insulation . . . insulation voids that create a serious loss of efficiency. There is no such difficulty with FOAMGLAS. This all glass insulation always maintains absolute dimensional stability.



**Vermin-proof!** Most insulations offer no protection at all against vermin in food processing, storage or handling operations. Rats and other vermin gnaw right through them. FOAMGLAS, on the other hand, affords an excellent vermin barrier. Its all-glass composition offers no food or nesting materials for vermin.



**Strongest!** FOAMGLAS has a compressive strength of over 7 tons per square foot (av. ult.). It forms a solid base for built-up roofing. It makes possible the placing of insulation beneath heavily loaded floors. And high strength FOAMGLAS permits such cost saving design innovations as free standing walls and partitions.



**Acid-proof!** There is often a lot of acid around a processing operation. Even the atmosphere around processing plants frequently has a high acid content. Acids will attack and destroy most thermal insulating materials, but they won't harm FOAMGLAS. This unique all-glass material is completely impervious to all common acids.

**pc** C O R N I N G



## From the Editor's Tranquil Tower

AN ARTICLE by Robert Moses, entitled, "Should Private Firms Plan Public Works?" appeared in the magazine section of the Nov. 16, *New York Times*.

The article is a good one. Like Moses, himself, it is a bit dogmatic and occasionally vague in detail, but the over-all message is clear and loud. Moses has nothing new to say to consulting engineers, and he has not found any supporting data more recent than the well known paragraphs from the second report of the Hoover Commission. All of this we have published in *CONSULTING ENGINEER* in one form or another over a number of years. It is not, therefore, so much what he has to say in his article that makes it important, but rather, it is who says it and to whom he is speaking.

When *CONSULTING ENGINEER* points out that public works can be designed more efficiently by private firms, we are talking only to ourselves—telling our consulting engineer readers what they already know but can do little about. We also can be recognized as being something less than impartial, for we have a special interest in the financial welfare of our readers.

When Moses writes in the *New York Times*, we have an entirely different situation, for here we have as an author a man who is not a consulting engineer but instead is a public official—perhaps the world's best known authority on public works. Here is a voice from the very top of the great mountain of public works officials, a voice that states unhesitatingly that public works planning can be done more effectively by engineers in private practice than by employee government engineers. To put it in his own words, Moses says:

"Government employees must take care of budgeting of programs, routine construction, overhead policy decisions, supervision, review and coordination of plans, maintenance and other essential overhead work. Thereafter, the use of outside professional firms and technicians is the logical and

economical method of progressing engineering and architectural design and supervision of most large construction projects."

This statement is elaborated in Moses' frequently colorful language. He points out, for example, that "As a squirrel buries nuts" a government engineering staff has a tendency to gather and store plans so as never to be without a good supply.

If Moses is an effective pleader of the consultant's cause, it is also true that the *New York Times* is as good a rostrum as he could find from which to speak. It has authority and dignity, yet it has wide circulation among the general public and public officials. These are the persons—the voters and those who must act as the voters desire—who must be convinced of the truth of Moses' words. Nowhere was this more clearly demonstrated than in California two years ago when the voters had an opportunity to speak directly on this question. They had a chance to choose between civil service and private practice engineering, and they chose civil service. The voice of Moses should have been heard by the voters of California two years ago.


There will be other opportunities in other states to convince the public and their political representatives, and this article can help. It is unlikely that the heads of state highway departments will reverse their policies because of Moses' article but it is strong testimony against the state and it is testimony by a most expert witness.

Copies of the article have been widely circulated—to engineering agencies of the Federal government and to state public works officials. A group of fourteen large engineering and architectural firms have had the piece reprinted and have distributed about 12,000 copies. It can be made even more effective by further distribution—distribution by consulting engineers all over the country. Not only should it be mailed to public officials, it also should be discussed with each of them, point by point, and this can only be done by personal contact in every county, city, and state. A campaign of this type could be of great value.

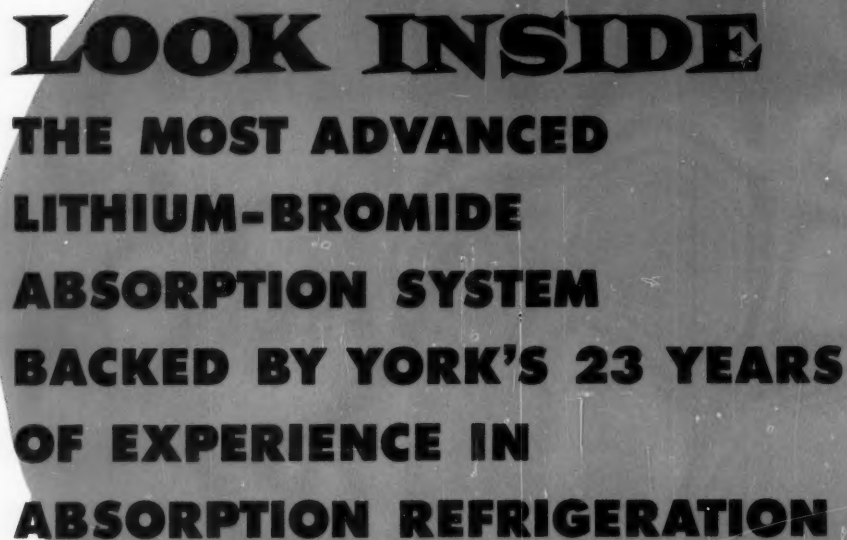
Reprints of the article can be had by writing W. J. Donoghue Associates, 10 Columbus Circle, New York 19, New York. ▲▲



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CREATIVE PRODUCT ENGINEERING FOR COMFORT  
NOW BRINGS YOU THE FOUR  
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THE MOST ADVANCED  
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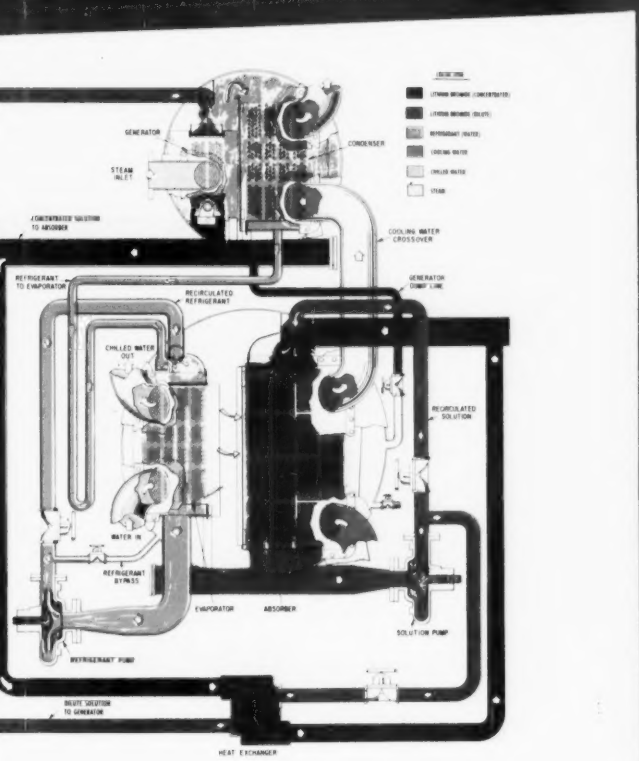
**LOOK INSIDE**

**Revolutionary 3 Pipe Induction System With Instant  
Response That Eliminates Zoning of Air and Water**



Here is an induction air conditioning system that is unusually simple to lay out, and yet possesses flexibility never before attained in systems of this kind.

Designed around YORK's... H.L. 1



You are looking at the latest development in automatic, heat-operated water cooling systems.

Low-pressure steam or high-temperature water is the activating medium. No motor drive, no expensive starters or heavy electrical conduit needed.

Tap water is the refrigerant, lithium bromide the absorbent. Once the system is charged they need never be replaced.

Savings in operation, installation and maintenance are the most important advantages here over motor-driven refrigeration systems.

In addition, YORK's perfected method of fluid distribution throughout the system requires less pump horsepower per ton of cooling.

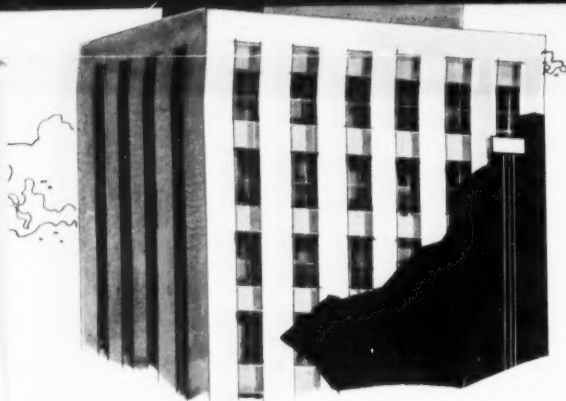
Notice how the lithium bromide solution trickles over the outside surface of the steam-filled generator tube bundle. System responds faster at start-up and can be more closely controlled to meet sudden load changes. There's less noise, too.

Wherever low-pressure steam or high-temperature water is available—in office buildings, hotels, hospitals and industrial plants—there's a place for a YORK Lithium-Bromide Absorption System. Available in capacities ranging from 100 to 740 tons.

## LOOK INSIDE

### The First Completely Packaged Hermetic Centrifugal Water Chilling System

You'll see a factory engineered-and-packaged centrifugal water chilling system, complete in every sense of the word. It's the YORK single-stage



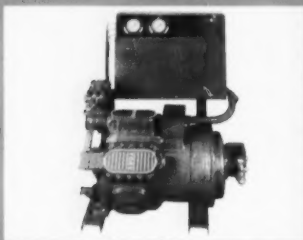
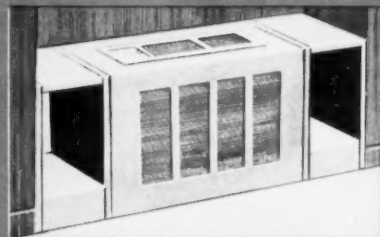
that is unusually simple to lay out, and yet possesses flexibility never before attained in systems of this kind.

Designed around YORK's new Hi-I induction unit, the 3-pipe system eliminates summer-winter changeover and nighttime shut-down, and offers dramatic savings in power and steam costs.

No zoning of ventilating air or supply water is required. Constant quantities are delivered uninterruptedly to all points. Room temperatures are completely and automatically controlled at individual room units.

Automatic unit control valve provides room occupants with 50% greater personal comfort control the year 'round.

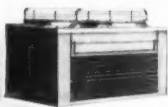
# Plus!



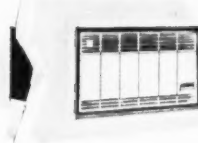
**Hermetic Compressor unit**, combines a proven YORK V/W compressor and a refrigerant-cooled motor, with an attractive, fully wired, totally enclosed control center. No belts, couplings or shaft seals. Requires less than seven square feet. In 10- to 45- ton nominal capacities.



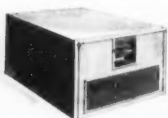
## LOOK INSIDE York Packaged Products For Answers to Your Special Problems:



**York Champion Air Conditioners** for commercial use are air cooled...use no water...deliver 10 to 15 tons of natural cooling. Have step-start, step-capacity control.



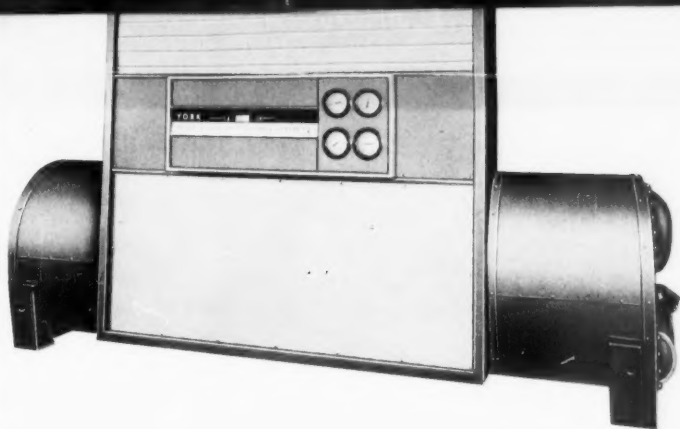
**York Room Air Heat Pumps** cool in summer, heat in winter. Three compact, stylish window units: (1) Citation, 230 V. (2) Medalist, 115 V, 7½ Amp., (3) Metropolitan, 230 V.



**York Residential Heat Pumps** cool in the summer, heat in the winter—using only outside air and electricity. Have twin cooling systems, twin auxiliary heaters.

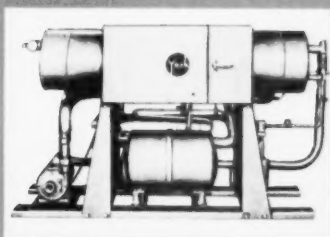


**York Furnaces** have exclusive Silver "V" Burners that provide more heat, more economically. Fully A.G.A. approved for use with natural mixed, propane or manufactured gas.



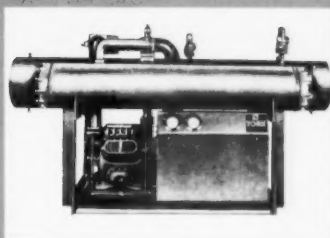
You'll see a factory engineered-and-packaged centrifugal water chilling system, complete in every sense of the word. It's the YORK single-stage TURBOPAK, and it's hermetic. Lighter and 50% smaller than any other comparable system, too. The secret lies in the built-in world-famous Borg-Warner transmission gear. There's a fully wired, electronic control center for precise, automatic capacity control. One piece, rigid base construction simplifies layout, eliminates field assembly.

**HI-1 Induction Unit**, featuring YORK patented primary air nozzles for quiet operation, meets air conditioning requirements for high secondary-coil capacities. Attractive factory-fabricated enclosures for that "built-in" look are also available.



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For system performance without maintenance worries, a YORK Certified Maintenance Contract is what you're looking for. Gives you complete maintenance, regular inspections, emergency service when required, all parts and repairs, spring and fall changeover, and start-up and shut-down. All for a nominal, agreed-on-in-advance fee.



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The reason? YORK's patent  
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20% more economical to oper

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- FROM 42% TO 67% MORE HEAT FOR THE SAME POWER
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**More YORK Central Station Air-Source Heat Pumps Have  
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# source Heat Pumps out-perform conventional systems!

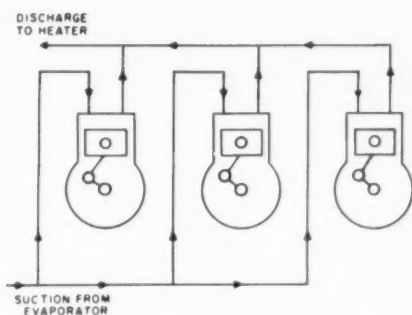
tented compound-compression design  
ump that delivers more Btu's per watt  
s. In actual installations, it has proved  
operate.

and incoming power lines (no coal, gas,

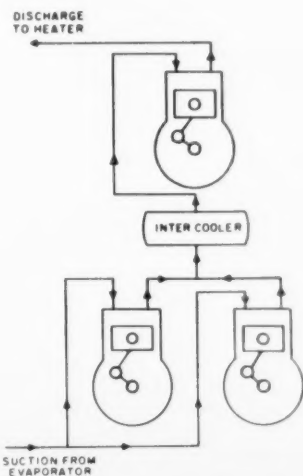
oil or supplementary electric heaters are needed) a YORK Heat Pump maintains year-round comfort conditions in commercial and industrial buildings of all types and sizes—even in areas having winter design temperatures below freezing.

It has all the advantages of separate heating and cooling systems without the disadvantage of costly seasonal shutdowns and start-ups. Space normally provided for boiler rooms, fuel storage facilities and chimneys can be utilized for business profit production.

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## Heard Around Headquarters

THE CORPORATE PRACTICE battle is expected to be fought on a number of new battlegrounds this year, with discussion or law changes contemplated in Quebec, Colorado, and Washington State. And the familiar rumblings are heard again in New York State as the Committee on Engineering Laws prepares for annual battle.

A committee of the Corporation of Professional Engineers of Quebec has recommended unanimously that the engineering by-laws be amended to provide that:

Only individuals who are members of the Corporation of Professional Engineers of Quebec may be authorized to practice the profession of engineering under Limited Company auspices or any other form of organization, and that these may only be authorized to practice under Limited Company auspices when a majority of the directors and a majority of the officers of their company are professional engineers.

At present, engineering regulations in Quebec do not provide for the practice of engineering through corporations. And according to a prominent Quebec engineer, the consulting engineers are generally opposed to corporate practice.

In Washington State, the engineers registration law provided for

corporate practice until the law was revised in 1947. The clause on corporate practice was dropped, and the attorney general later ruled that under the revised law corporations could not be licensed and could not practice engineering.

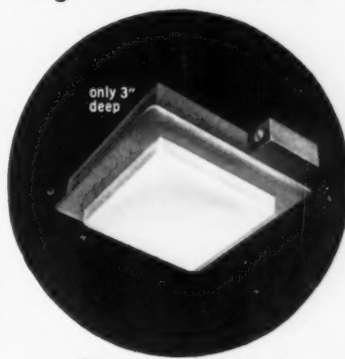
Last year, a bill was submitted by corporations who were then doing engineering work in the state, but representatives of various engineering societies did not favor the bill. However, the societies stated that they would agree upon the wording of a clause that would provide a practical arrangement for the practice of engineering by corporations to be submitted at the 1959 session of the Washington State legislature.

In Colorado, the legislative committee of the Professional Engineers of Colorado has drafted a bill that would allow a corporation to practice engineering provided everyone in charge of design or supervision is a registered engineer.

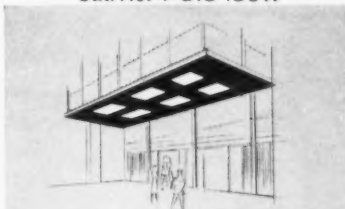
One of the most interesting engineering laws is the Newfoundland Engineering Profession Act, which provides for a fine of \$200 to \$1000, or a prison term of not more than six months, for "a" director of any corporation that has a nonlicensed person doing engineering. The question is just how

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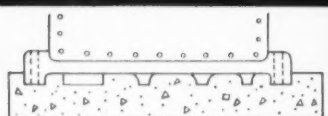
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they select the director to pay the fine or serve the prison term.

## ASEIB Adds to Roster

The American Sanitary Engineering Intersociety Board has accepted an additional 100 engineers for certification, bringing the total number of "sanitary engineers" to 979.

Of those previously certified, 555 were qualified through specialization in water supply and waste water disposal, 198 in public health, 31 in industrial hygiene, 10 in air pollution control, and 5 in radiation hygiene and hazard control. An additional 80 had qualified in the general field of sanitary engineering.

The first roster will be published by the board this month.

At a recent trustees meeting, Thomas R. Camp, of Camp, Dresser & McKee, Boston, was re-elected chairman, with R. E. Lawrence, of Black & Veatch, Kansas City, Missouri, re-elected vice-chairman. R. S. Rankin of Stamford, Connecticut, who is beginning his second term as treasurer, was named secretary to succeed Francis B. Elder.

## Progress on New Headquarters

If sufficient funds can be collected, construction of the new engineering headquarters will begin in mid-1959, according to S. W. Marras, secretary of United Engineering Trustees.

Marras will be convinced that all is well when \$7 million of the \$10 million estimated cost has been pledged. Since the present headquarters is valued at approximately \$2 million and more than \$5,130,000 already has been pledged, the 1961 goal for the move to a more fashionable neighborhood does not look too remote.

Annual report of the UET revealed that the basement and first and second floors of the building will house joint society facilities including the cafeteria, private dining rooms, exhibit hall, large

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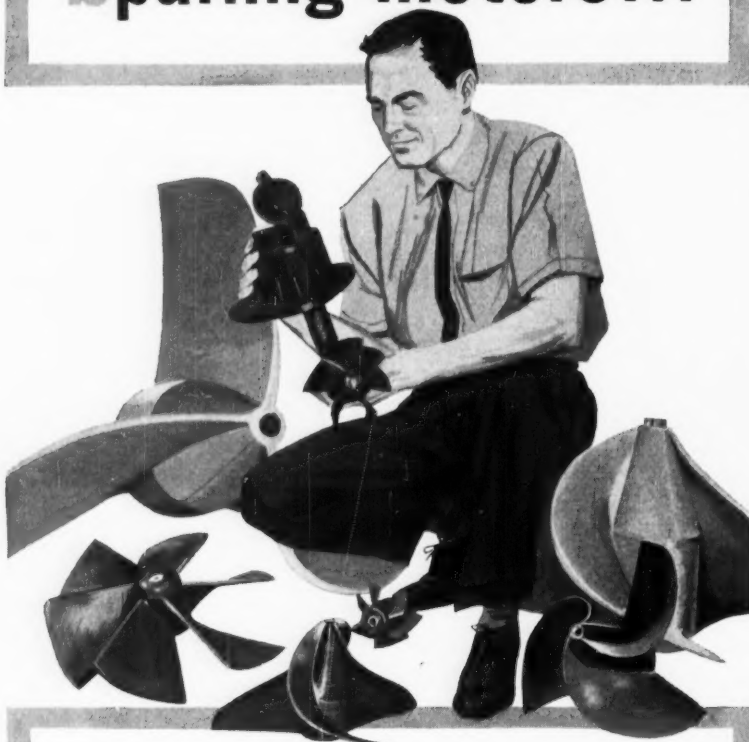
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meeting room to seat 400 persons, the Engineering Library with accessory spaces, and central offices for duplicating, shipping and similar services. This was the first indication that central service offices had been agreed upon.

### "Waste" in School Construction

New York City's Controller, Lawrence E. Gerosa, has ambitions of being mayor, according to many newspaper columnists. He recently has been on the front pages of all local newspapers with allegations of wholesale waste and extravagance in school construction.

Gerosa's primary target for his accusations seemed to be the Board of Education, but his buckshot tactics also hit consulting engineers and architects.

No newcomer to politics, Gerosa made his accusations in installments. First, he released "excerpts" of a forthcoming report. He charged the Board of Education had wasted \$100 million in school construction funds in the past seven years. The Board disagreed violently.

Gerosa blamed the wastes in part on foundation changes due to soil conditions, faulty plans due to errors or poor design, and "requirement afterthoughts."

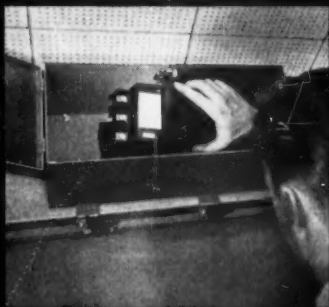
Elaborating on his charges of waste, Gerosa then said Tippetts-Abbett-McCarthy-Stratton had been given a six-month contract, at a cost of approximately \$150,000, to compute the value of extras. And for a similar period, Joseph Weiss, consulting engineer, was paid \$175 a day for an approximate total cost of \$55,000. These engineers processed approximately 4200 change orders evaluated at approximately \$1 million on 67 schools, Gerosa continued. The Board of Estimate also approved the hiring of two engineers to keep up with change orders. Gerosa said this should have been done by 25 employees of the Board of Education.

Gerosa also complained that fees

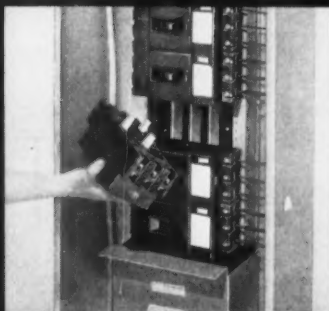
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paid by the Board of Education to architects are higher by 25 percent than fees paid by other city agencies. He said architects get five to six percent for Board of Education projects, and only four percent or less from other agencies.

The New York Association of Consulting Engineers sent Gerosa a letter stating:

"Without attempting to justify the entire architectural fee, although there is indisputable evi-

dence that they are lower than fees paid by schools in bordering communities, we have substantiated the fact that the portions of the architectural fees paid for the engineering work are most inadequate . . . The fees paid by the Department of Public Works are not comparable because the character of the work is different, and unfortunately, are even more unsatisfactory than the fees paid by the Board of Education.

"The significance of this to the city is that unless satisfactory fees are paid, the more reputable and experienced engineers will not undertake this work for the city and the construction done under this important program will then suffer accordingly."

The New York Chapter of AIA also had a few words to say. Comparing the fees of architects for school work with those for other public works either constitutes a naive approach or is a deliberate attempt to dupe the public, according to Albert H. Swanke, chairman of the fees and contracts committee of the New York AIA.

Swanke said architectural fees paid on many public projects have in fact been too low, and architects in many instances have had to dip into their own pockets to meet payrolls and overhead.

#### ECPD Tax Classification

The Engineers Council for Professional Development, which applied more than one year ago for clarification of its tax status, has been notified that the government is considering giving ECPD a "business league" classification.

Although this classification would leave ECPD tax free, it would not allow gifts to ECPD to be deductible for the donor.

This clarification of the ECPD tax status would lead to an even more interesting problem. If ECPD and the Engineers Joint Council merged (a committee has been formed to look into this possibility), they could not be housed in the new engineering center under present United Engineering Trustees rulings.

#### Interview with ASME President

Glenn B. Warren, vice-president and chief consulting engineer, turbine division, General Electric, and new president of the American Society of Mechanical Engineers, intends to concentrate on unity, improved technical data, and improving the status of the engineer in

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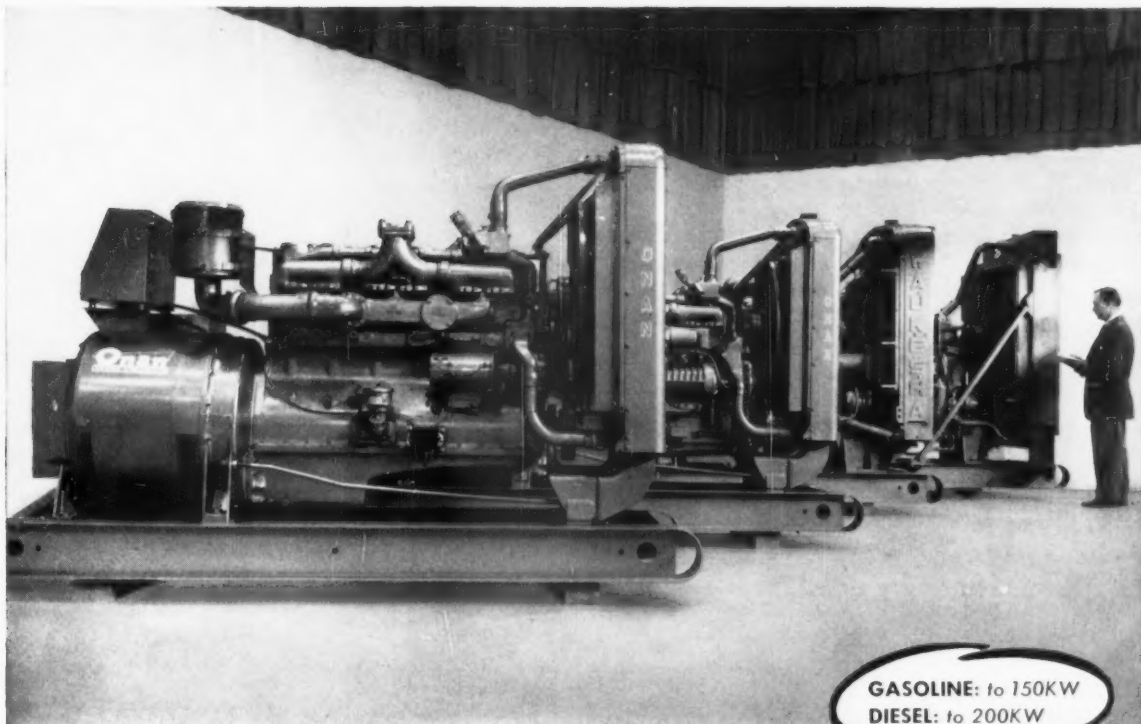
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All models are powered by heavy-duty industrial engines carefully matched to the power requirements of the generator.

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Onan builds Electric Plants from 500 watts to 150KW A.C., gasoline-powered; 3,000 watts to 200KW A.C., Diesel-powered. Portable, primary, and standby models. D.C. battery chargers and separate generators also available.

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the opinion of the American public.

In an interview at the close of the ASME annual convention in New York City last month, Warren said he thinks the ultimate aim of unity sometimes is obscured by too much attention to the methods of obtaining unity. It is the final goal that is important.

Prior to the convention, ASME ideas of how unity would be attained were a little hazy. Former president James N. Landis had en-

dorsed the AIEE functional plan in speeches. And the ASME Committee on Review of Engineers Joint Council had recommended that ASME "annul" its approval in principle of the functional plan.

Warren said he does not endorse "unity through EJC," as all other Founder Societies except the mechanicals and electricals have done. Nor does he endorse the functional plan as is.

Instead, Warren said, the ASME

has prepared a modified functional plan which has been circulated to the other Founder Societies and the EJC for their opinions. The modified plan is offered as "intermediate thinking, not as a rigid proposal," Warren stressed.

How does the ASME modified functional plan differ from the original?

"The AIEE functional plan is three-headed," Warren explained, "and as such, is not a true unifying plan." To illustrate, Warren said the ASME does not feel it could turn over all professional matters to the National Society of Professional Engineers and retain no means of control. The rights of all ASME members — including those who are not NSPE members — must be protected.

Instead of "three heads," the modified ASME plan has "three sub-heads." The educational, professional, and technical aspects of engineering could be handled as suggested in the functional plan with one important difference. The ASME suggestion includes the creation of a coordinating agency to head the three subcommittees. This would be a new group, and Warren did not speculate as to who would be members of the coordinating agency.

Does Warren think there is a possibility of unity during his term of office?

"We want unity, but there are many groups to be satisfied and this will not be easy. Remember, engineers have talked of unity for 78 years and have gone through four or five unity plans. Right now we are more interested in obtaining final unity than in rushing into something."

Warren also wants to put increased emphasis on the dissemination of technical literature.

"We best serve the engineer, professionally, by making him more competent technically," Warren pointed out.

Industry has spent billions on original research, as compared to

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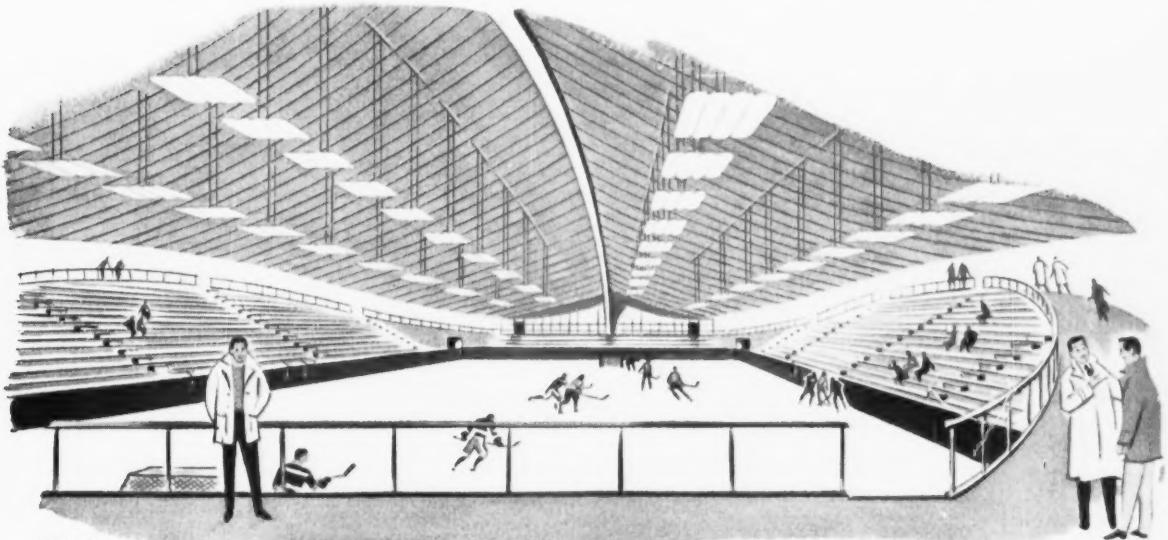
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## YALE UNIVERSITY'S NEW HOCKEY RINK

*...one of the most clearly expressed  
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Architect: Eero Saarinen and Associates, Bloomfield Hills, Michigan  
Consulting Engineers: Severud-Elstad-Krueger, New York City  
Contractor: George B. H. Macomber, Boston and New Haven

Designed by architect Eero Saarinen, the David S. Ingalls Ice Hockey Rink at New Haven, Connecticut, is the newest and one of the most breathtakingly beautiful suspended roof structures in existence.

The rink is formed by two tremendous lyre-shaped compression arcs resting on their sides, with a great, upright reinforced-concrete parabolic arch serving as the roof's backbone. The two compression arcs serve a dual purpose as wall and buttress.

All cables for this outstanding example of what can be considered a truly new building principle were supplied by Roebling. Initially, six 1 3/4" diameter galvanized bridge strand arch bracing cables were put on to support the parabolic arch during erection. Permanently, there are one hundred and twenty 15/16" diameter galvanized bridge strand roof-supporting cables. All strands are of various lengths and were prestretched, and all end fittings were proof loaded. The cables were installed in accordance with theoretical dimensions and no undesirable cable adjustments were found to be necessary, proving the accuracy of cable measurement and socketing.

Roebling's interest and constant activity in all phases of the suspended roof principle stem from its long and invaluable experience in *all phases of steel in tension* in all kinds of structures: bridges, ski lifts, conveying systems and guyed towers are some of the fields in which Roebling has pioneered with significant success. We will be pleased, at any time, to make available to you our findings and discuss with you our activities in this field... a field that gives every evidence of becoming one of the most important construction modes of all times. Write Bridge Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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the thousands available to engineering societies. Warren wants to gather and use much of the available industrial data which has not yet been published. "We should build on the technical basis we now have, yet fill existing voids," he added.

The new ASME president also wants to do everything possible during his term of office to increase public and government appreciation of the engineer, and to place him in his proper place beside the scientist in the nation's technological development.

What benefits the engineer in general benefits the mechanical engineer in particular, Warren explained, "because mechanical engineering permeates a wider range of disciplines that does any other branch of engineering."

#### Bridge Recommendations

The Department of the Army has announced that no change will be made at this time in the present

standard 80-ft vertical clearance required for bridges over the Atlantic Intracoastal Waterway.

Highway interests had requested 55-ft vertical clearance fixed bridges. However, an economic analysis led to recommendations of a movable bridge of intermediate height satisfying both interests.

#### ASHAE and ASRE Merge

As predicted, the American Society of Heating and Air-Conditioning Engineers and the American Society of Refrigerating Engineers voted last month to merge.

With a high percentage of the membership of both groups voting, tallies showed ASRE 73 percent and ASHAE 93 percent in favor of the merger.

Because of legal technicalities, the merger cannot become effective until after Feb. 15.

In the meantime, business will continue as usual for both groups. The ASHAE Fourteenth International Heating & Air-Conditioning

Exposition in Philadelphia will be held as scheduled this month.

#### Engineers in Washington

The apathy of many engineers toward the government's influence on their business and professional problems was criticized recently at a meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers by Felix E. Wormser, former Assistant Secretary, Department of the Interior.

Wormser said engineers and many businessmen leave governmental problems "to their trade associations, but some organizations that operate in our field are so beset with conflicting interests and policies they cannot function too effectively or advantageously in Washington."

And few engineers serve in Congress:

	House	Senate
Attorneys	234	65
Businessmen	100	15
Farmers	28	3
Educators	22	1
Doctors	4	0
Military	4	1
Engineers	2	2
Miscellaneous	41	9
	<u>435</u>	<u>96</u>

#### CEC Joins EJC

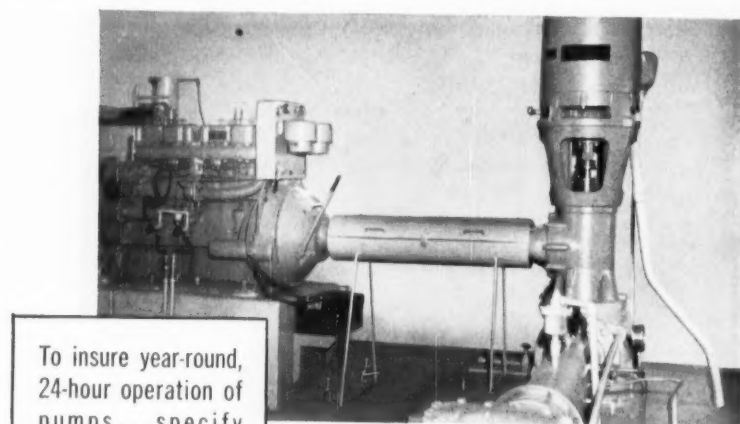
The Consulting Engineers Council has been accepted as the seventy-first affiliate member of the Engineers Joint Council.

The CEC now has the privilege of sending observers to any EJC gathering and is allowed one vote at the EJC annual meeting.

The American Institute of Consulting Engineers is also an affiliate member of EJC, so there are now two groups representing engineers in private practice in EJC. This could bring about much closer cooperation for the good of the engineering profession.

#### Victory for NSPE and EJC

The Supreme Court of the United States has ruled, by a vote of seven to two, that the National Labor



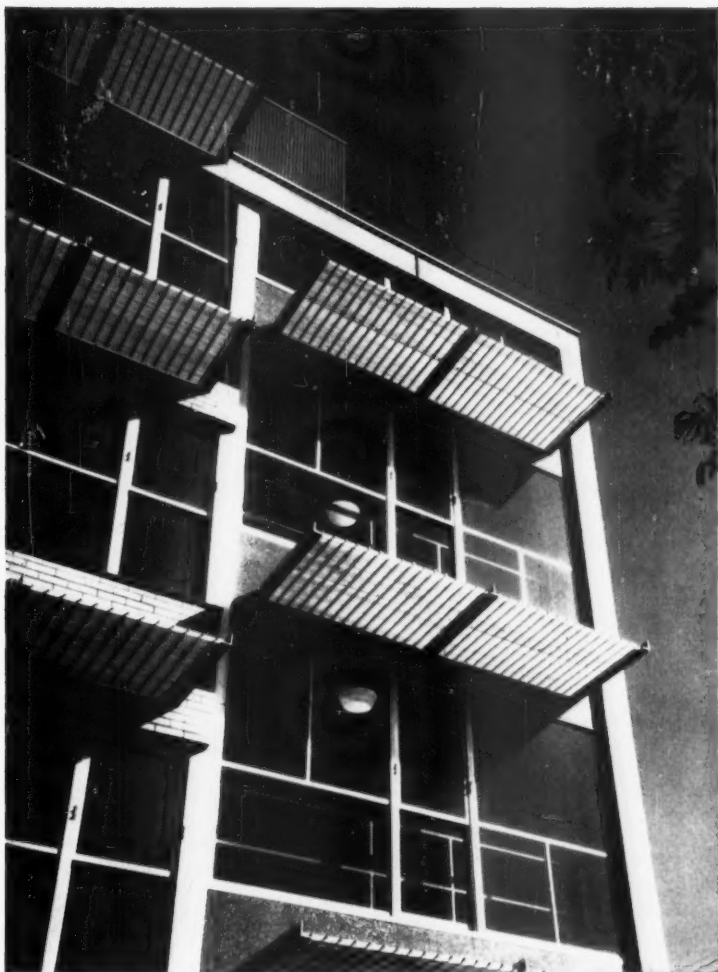
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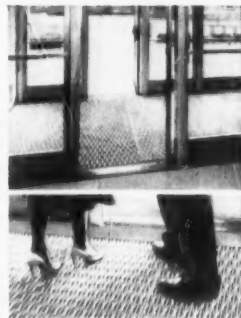
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Representatives in Canada and Mexico

Relations Board acted illegally in directing the inclusion of nonprofessional employees with engineers and scientists in a collective bargaining unit without prior approval of the professional group.

The majority decision, penned by Associate Justice Charles E. Whittaker, was a sharp defeat for NLRB, which had maintained that its rulings were appealable only if they become the basis for an unfair labor practice order, and a clear-cut victory for the National Society of Professional Engineers, which had fought the NLRB directive. Engineers Joint Council had earlier filed a brief with the high court supporting the contentions of NSPE.

The ruling centered on the denial by NLRB of an election by engineers at the Cheektowage, New York, plant of Westinghouse Electric Corporation to determine whether a nonprofessional minority could join their collective bargaining unit. NLRB directed that

the nine nonprofessionals be included in the engineers' union because they shared "a close community of employment interest."

#### IACE Legislative Approach

The Illinois Association of Consulting Engineers, at a recent meeting in Springfield, was told by their new legal counsel, attorney Paul W. Gordon, Jr., that the best interests of IACE would be served by a cautious approach to the state legislature. He also pointed out that many engineers' problems do not lend themselves to a legislative approach for solution.

Instead of running to the legislature at every opportunity with proposed bills to remedy even minor items, he recommended that the Association try first to work directly with the offending organization. Attorney Gordon indicated that legislators soon tire of frequent visits by one organization — and becomes less receptive to legislation dealing with important problems

that can be solved only by new laws. And any organization that constantly tries to solve its problems by legislative means soon makes a host of enemies, the attorney concluded.

#### New EJC Committee

The board of Engineers Joint Council has approved the formation of a Committee on Engineering Information.

Replacing the former EJC abstracting committee, the Information Service will act in an advisory capacity to the new Science Information Center in Washington, D.C.

#### 1959 Officers of NYACE

John Hennessy, Jr., of Syska & Hennessy, is the new president of the New York Association of Consulting Engineers.

Others elected at the annual meeting in mid-December, were Richard T. Baum, of Jaros, Baum & Bolles, and Sigmund Roos, of Roos & Snow, vice-presidents; Samuel A. Bogen, Consulting Engineer, secretary; and Joseph L. Fraoli, of Fraoli, Blum & Yesselman, treasurer.

#### ASME Specialization

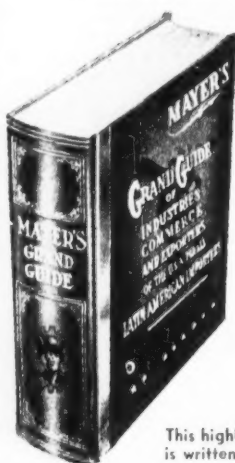
ASME membership now stands at 56,546 — an all-time high — as compared to 52,012 members at this time last year.

During 1958, ASME put into effect a policy of increased emphasis on "specialization" in the various technical fields. Instead of the traditional spring and fall meetings, more (26 national) technical meetings were held. The result was a record-breaking total attendance of more than 20,000.

Also in line with the increased specialization, ASME transactions are being "modernized." In the past, technical papers in all fields except applied mechanics were combined into a single *Transactions*. Now the *Transactions* will be divided into Basic Engineering, Engineering for Power, and Engineering for Industry. ▲▲

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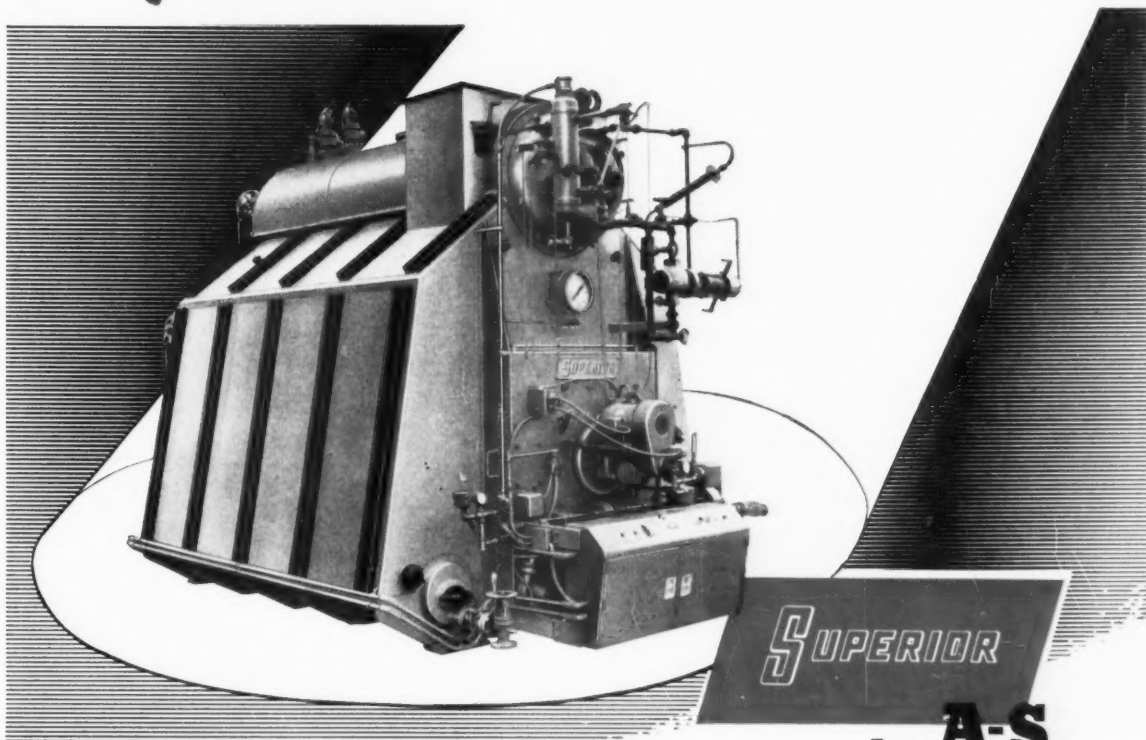
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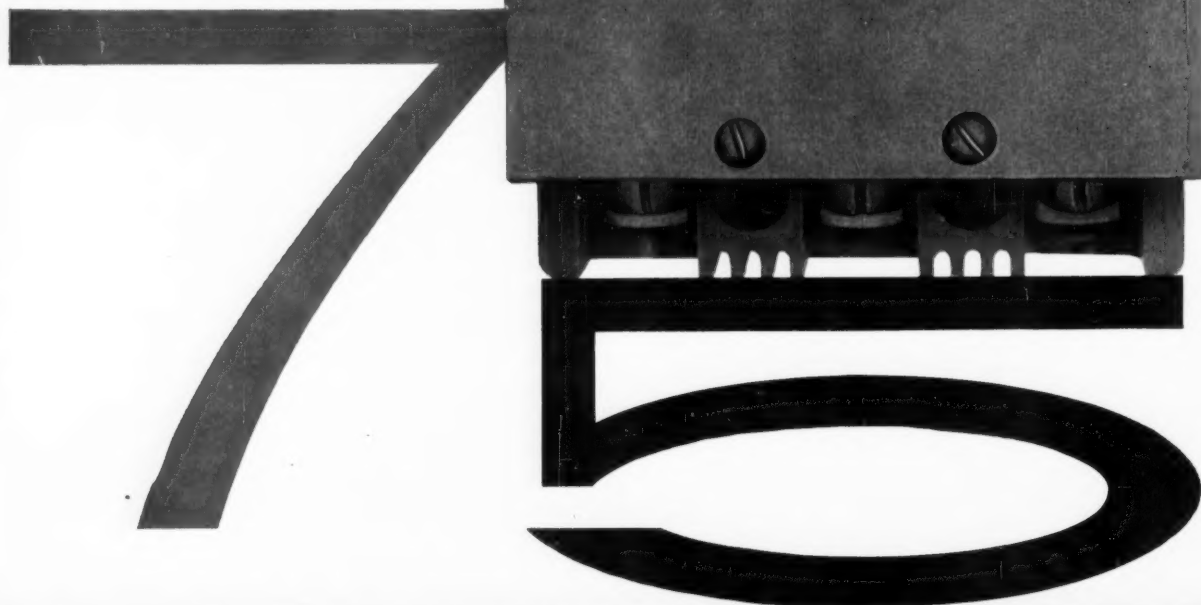
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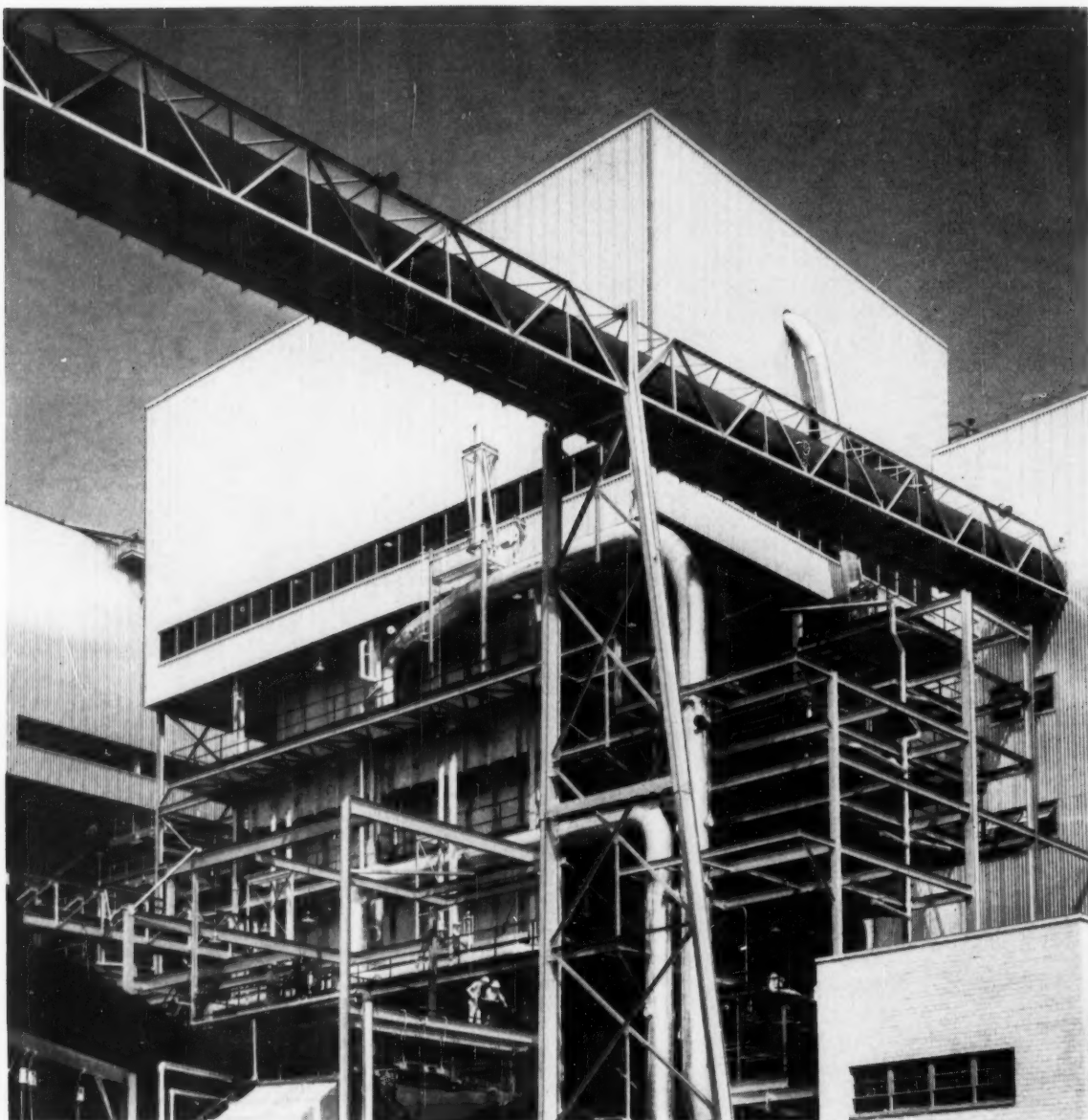
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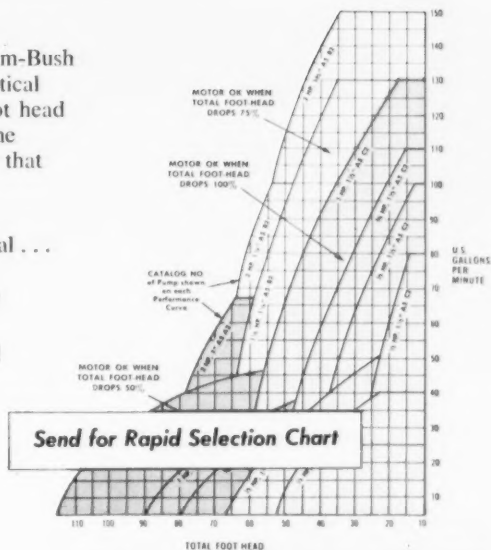


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# The Word From Washington

EDGAR A. POE

Consulting Engineer Correspondent



THE BUREAU of Public Roads, in reply to a query by CONSULTING ENGINEER, declared that its policy holding that all engineering work should be done by the various highway departments, unless infeasible, is unchanged.

Specifically, BPR was asked to comment on the article, "Should Private Firms Plan Public Works," by Robert Moses of New York, published in the *New York Times Magazine* of Nov. 16, 1958. This article states that private consulting engineers are better able to serve the public interests than those affiliated with a state or local gov-

ernment agency. Instead, BPR cited a policy memorandum of June 4, 1954 anent the use of consultants and indicated that it proposes no changes.

The policy declaration states that the employment of competent and qualified consulting engineers or private engineering organizations for the design and preparation of plans, specifications, and estimates for highway improvements involving Federal-aid funds may be necessary when:

¶ The engineering personnel of the state is insufficient to perform the required work on time;

¶ The State has a program substantially longer than normal and it desires to employ consulting engineers rather than build up its organization for a short period;

¶ The unusual character of the work requires highly specialized knowledge and experience beyond the qualifications of the State's engineering staff.

A spokesman for the Bureau said the various state highway departments have made increasing use of consulting engineering firms since the passage of the 1956 Federal-Aid Highway Act. This has been due to the greatly increased work load as well as to the vast number of projects requiring highly specialized experience.

Thus, the position of BPR, when asked to reply to Mr. Moses, is in effect: Our policy relative to the employment of consulting engineers, adopted in 1954, is still in effect; the basic philosophy of BPR is unchanged.

THE SOUTH, with more than its share of domestic problems, nevertheless is moving ahead in nuclear development. If the power of the atom is going to open a new field of wealth, the South intends to be in the forefront.

There are now about 105 United States electric utilities participating in more than a score of development projects, and a substantial number of these are in the South. And the nuclear energy program being carried out in Dixie has attracted favorable attention from



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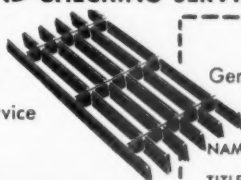
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the Atomic Energy Commission and from Congress.

### Broad Program

The Southern Governors' Conference, involving a 16-state region from the Chesapeake Bay to the Rio Grande River, is pushing the program. The Regional Advisory Council on Nuclear Energy, sponsored by the Southern Governors' Conference, has initiated a series of atomic projects in the fields of engineering, industry, medicine, and education.

The Advisory Council now has reminded the states' chief executives that the region should remain alert against complete Federal control of nuclear energy. The Council, after a study, is recommending an interstate nuclear energy compact for cooperation in the solution of mutual problems.

Two private ownership nuclear power projects in the South are beyond the planning stage. Carolinas-Virginia Nuclear Power Associates, Inc., owned by four utilities in North Carolina, South Carolina, and Virginia, expect to complete a \$44-million power plant at Parr Shoals, S. C. in 1962. The East Central and Florida West Coast Nuclear Power Corporation and the Tampa Electric Company, plus 12 firms in Indiana, Kentucky, Michigan, Ohio, and Pennsylvania are starting work on a 50,000-kw plant in Florida.

Plans also are being made to erect a \$12-million testing reactor project by Industrial Testing Reactors, Inc., at Wadesboro, N. C. by 1960. Engineers express confidence that this project will materially benefit Southern economy.

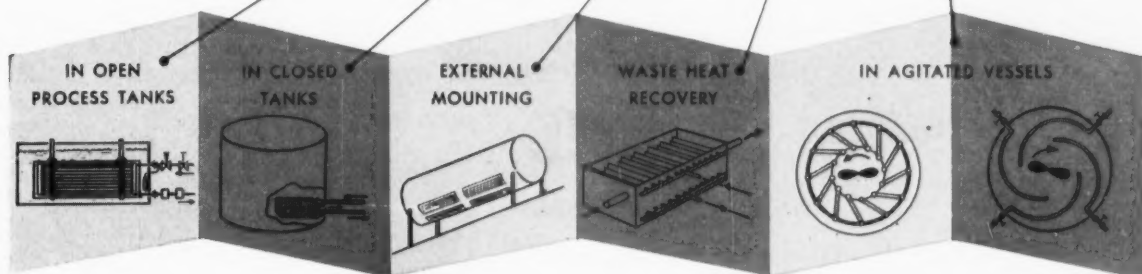
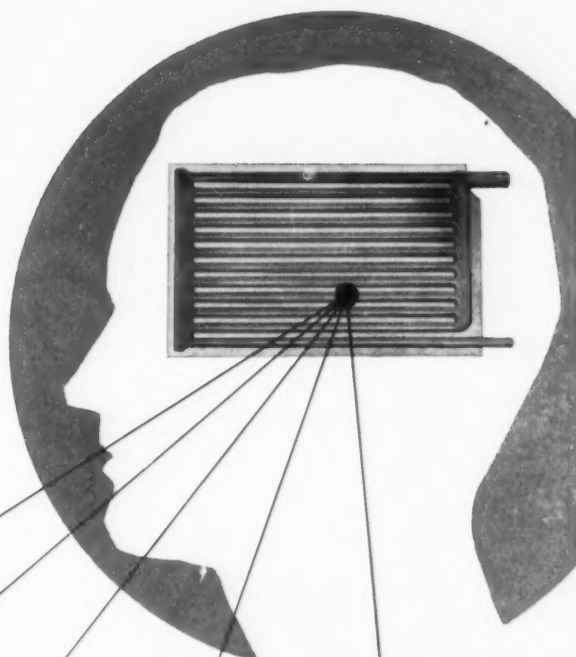
The Middle South Utilities Inc., holding company for Louisiana Power & Light Company, Mississippi Power & Light Company, Arkansas Power & Light, and New Orleans Public Service, Inc., is looking into the building of a prototype nuclear power reactor for its system. The four-year study will involve an outlay of more than

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\$5 million. Middle South currently depends primarily on natural gas.

#### Production Facilities

There is nuclear activity for the Navy and private shipbuilding in the South. The Ingalls Shipbuilding Company is building the atomic submarine Sculpin at Pascagoula, Miss. Newport News Shipbuilding and Dry Dock Company is building the nuclear submarine Snook and the aircraft carrier Enterprise.

At Lynchburg, Va., Babcock & Wilcox is doing development work on the nuclear ship Savannah. At Chattanooga, Tenn., Combustion Engineering, Inc., which manufactured equipment for the nuclear submarine Seawolf and the reactor vessel for the nation's first full-scale commercial atomic power plant at Shippingport, Pa., is manufacturing nuclear components.

The Babcock & Wilcox nuclear facilities plant, completed in Vir-

ginia in 1956, was the nation's first major plant at private expense to manufacture and test nuclear fuel elements and related products. Recently floor space was increased by 150 percent. The plant now covers 112,000 square feet, and some 550 people are employed there.

#### Council Report

In its report to the Southern Governors' Conference, the Regional Advisory Council declared that it would be wise for the South to look not only to the immediate future, but to 20 or 30 years hence "when the atomic industry will have expanded immensely, perhaps even beyond the rosiest estimates of today. The impact of nuclear developments on government, health, education, industry, and the professions . . . will become more pervasive with the passage of time."

The report went on to declare that the transfer from the Federal government to the states of the responsibilities in certain aspects of atomic energy, including health and safety considerations, is opposed by advocates of a strong central government. Therefore, it is up to the various states to decide now what responsibilities they are ready to assume.

As the atom opens potential new avenues of wealth, the states and local governments will have to be concerned with additional responsibilities. These will include regulation and inspection in connection with the uses of fissionable materials; enforcement of state codes written for the protection of workers and the public; safety regulations concerning the transportation of nuclear materials; waste disposal and storage problems; water and air pollution; background radiation studies; government-industry cooperation in public relations; university and college requirements for nuclear facilities; determination of insurance and power rates; and numerous other problems that will affect consulting engineers. ▲▲



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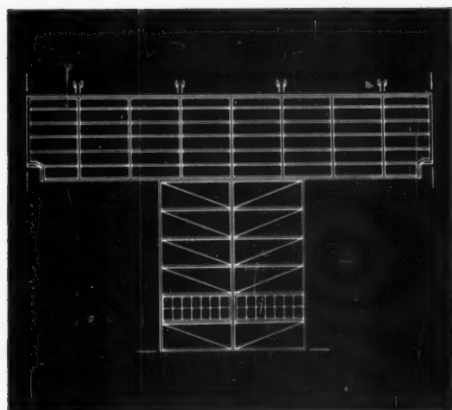


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The door illustrated is built with a one-piece, hinged-type upper section and swinging lower sections, all power-operated. Other Byrne Crane Door designs are available to meet any requirements.

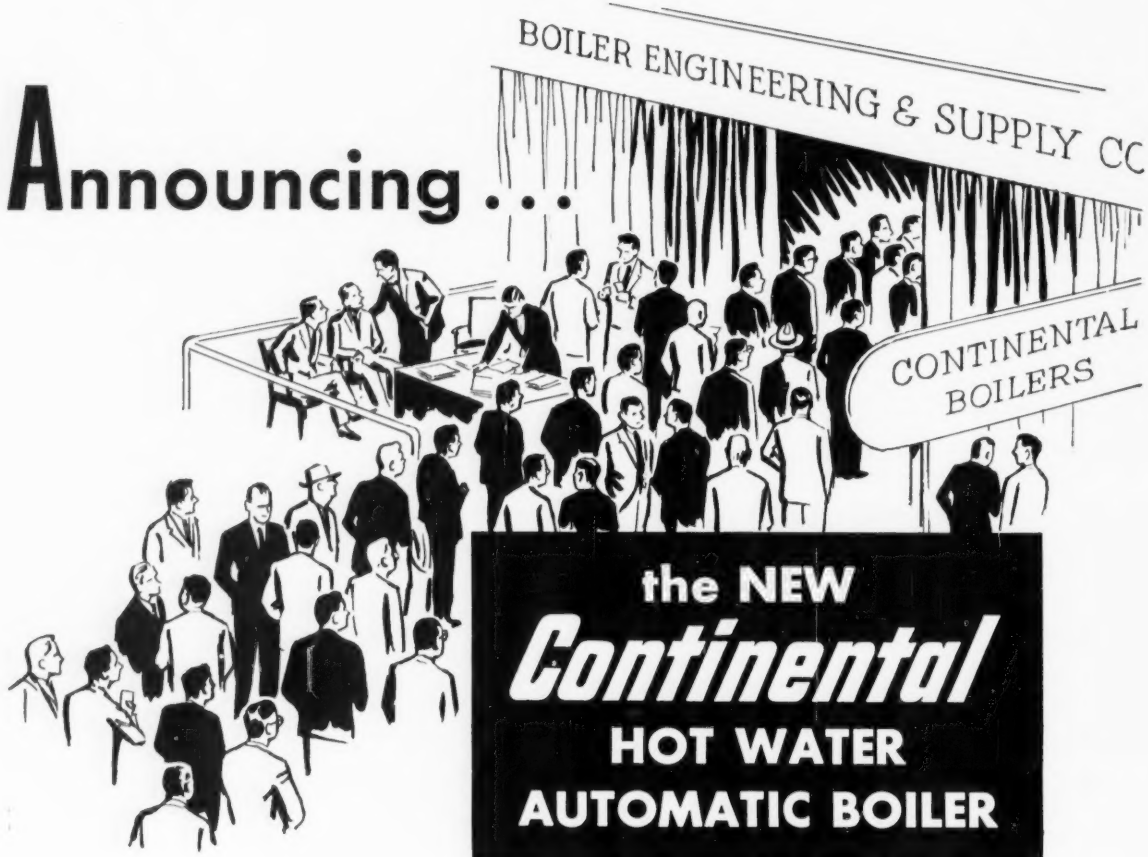
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**BOILER ENGINEERING & SUPPLY CO., INC.**  
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**That is the experience  
of THE HAWAIIAN  
ELECTRIC COMPANY**

Of the eight piping contracts the Hawaiian Electric Company placed with Midwest during the past quarter century, two were for the L. A. Hicks Plant shown above.



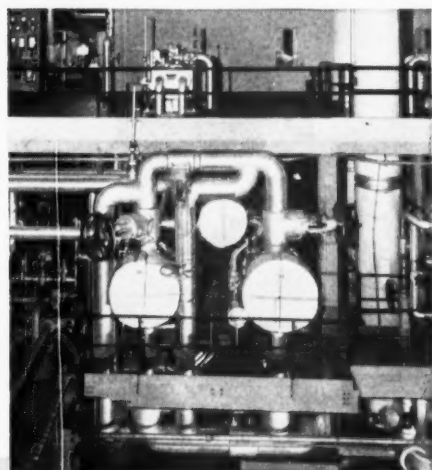
Boiler feed piping fabricated and installed by Midwest for the last unit in the L. A. Hicks Plant in Honolulu.

Benefits that Hawaiian Electric and many other electric utilities get by using Midwest Piping include:

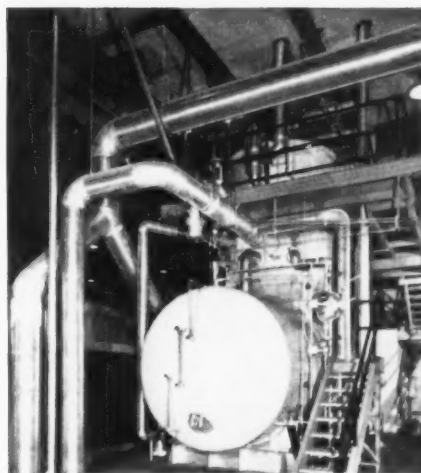
- Unequalled experience of Midwest fabrication and construction organizations.
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- Continuous piping research and development.

This adds up to a better piping job . . . on time and at minimum cost. It will pay you to call in Midwest the next time you need piping.

**8  
\* CONTRACTS SINCE 1933**



(Left) Showing Midwest Piping for horizontal and vertical feed water heaters for last two units at L. A. Hicks Plant.



(Right) Main steam and deaerator piping for last unit. Design conditions are 1500 psi and 950°F.

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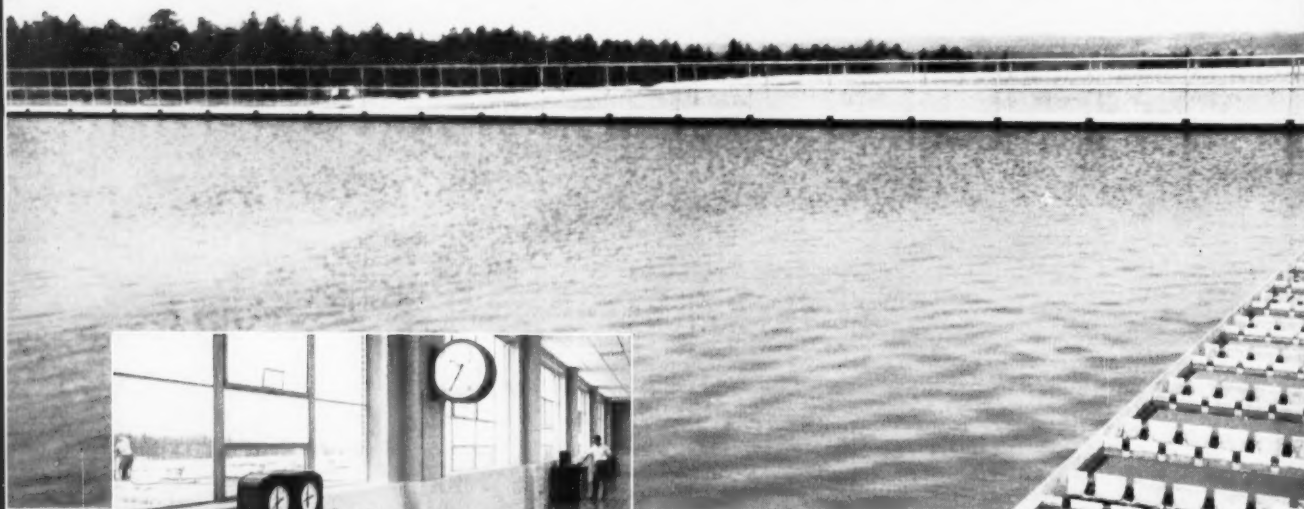
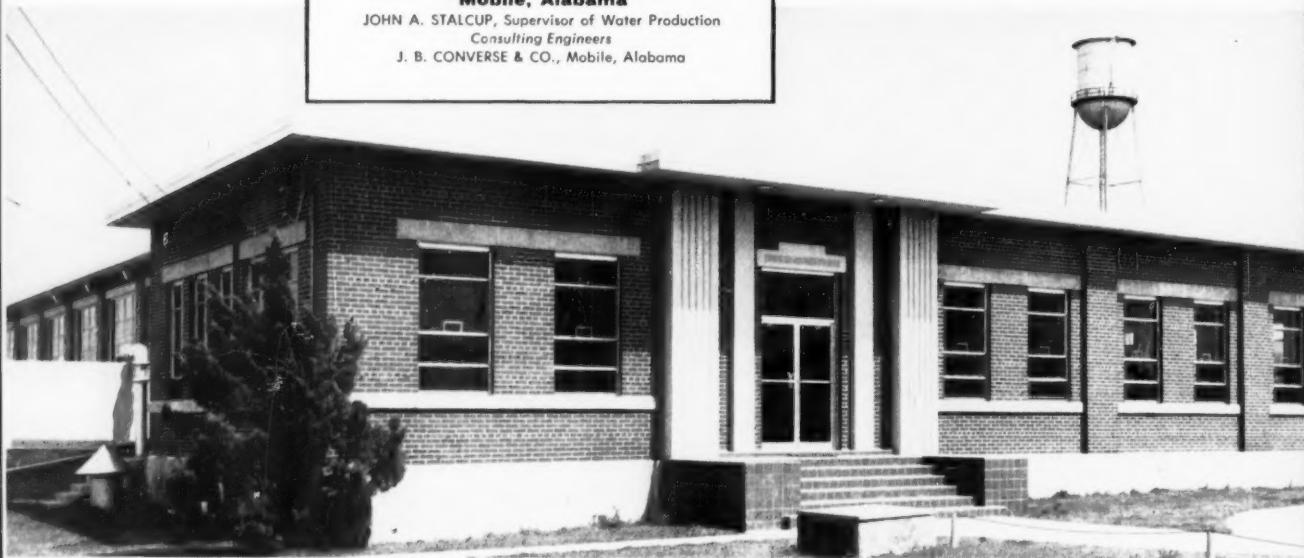
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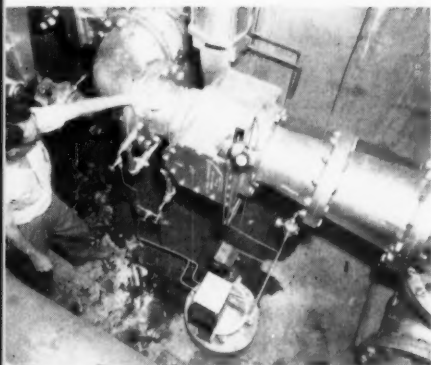
## Water Treatment Plant Expanded . . . SINGLE, RESPONSIBLE SOURCE FURNISHES CONTROLS and CHEMICAL FEEDERS

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Better coordination, through B-I-F's ability to offer a ONE SOURCE — ONE RESPONSIBILITY policy, brought immediate savings . . . during the installation and start-up stages. Fast, convenient service through local offices was another deciding factor.

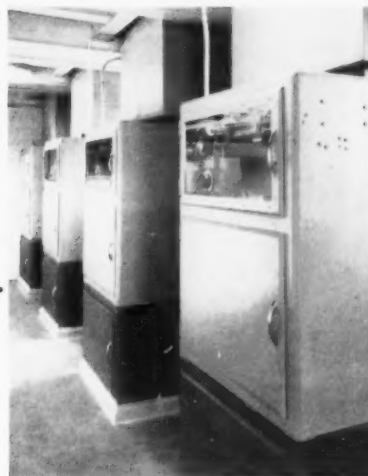
If greater systems reliability and operating economies interest you, write for details . . . to **B-I-F Industries, Inc., Utilities Sales,**  
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Builders Pneumatic Master Control System simply and rapidly provides remote rate-of-flow setting.

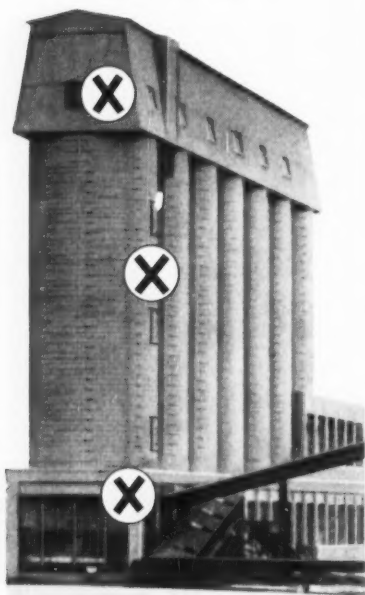


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Omega Chemical Feeders were selected because of their 100:1 feed range at high accuracy.

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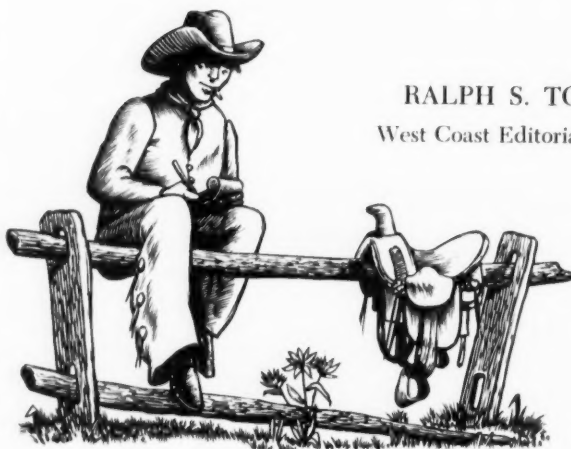
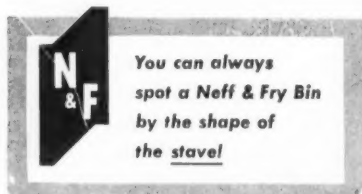
## It takes more than muscles to build a storage bin

Before the physical work of building a bin begins, we must know the problems involved at the *Three Critical Points*.

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When planning your next storage bin, may we sit in on the very early stages of planning?

**NEFF & FRY COMPANY**  
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RALPH S. TORGERSON  
West Coast Editorial Representative

## Report from the West Coast

WHEN IS A PROPOSAL a bid? Undoubtedly there are many requests for proposals where the intent simply is to determine qualifications for engineering work, but all too often the request is a device to obtain competitive bids. Both the California and Oregon consulting engineer associations considered the question in recent meetings.

### California Meeting

At the San Francisco CEAC meeting William W. Moore, of Dames and Moore, defined a proposal as a bid "if the client uses the price for comparison with the price of another engineer." The difficulty, he pointed out, is that it is necessary to pass judgment on the intent of people, and there is no way to legislate or enforce moral intent. "On the part of both engineers and clients," said Moore, "a desire for good moral intent can come only from within."

"It is my opinion that a bidding situation exists whenever there are two or more proposals which include a statement of actual or estimated price in dollars. In many instances the client says that he will not necessarily accept the low

price, but even though this may be his intent, once stated the price becomes a dominant factor in his thinking. I have seen instances where a board of trustees, after looking at three proposals, decided that the highest one was too much, the lowest one was too cheap, so they took the middle one. This is certainly a blind and unsatisfactory way to select professional services. They might as well select a surgeon with middle-sized hands.

"I realize that there is no unanimity of opinion among practicing engineers in this area. There are many engineers who believe a client is entitled to comparative proposals from different engineers provided he states that he is not going to select the lowest price. My belief is that as long as engineers cooperate in these practices, they are contributing to the degradation of their profession and encouraging larger and larger segments of engineering work to be taken over by borderline practitioners on one hand and expanded governmental organizations on the other.

"From the client's standpoint, it may seem that he should be entitled to compare both price and

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service. If this were possible it would be a desirable situation. The fact is that service in an engineering contract cannot be accurately defined. There is no way to define the quality and extent of service to be rendered by one engineer or another. Therefore, when price is stated, unavoidably it becomes a dominant factor for those charged with making a selection.

"I do not believe it is possible to attempt any rigid disciplinary code. Rather, progress on this mat-

ter can be made only by continual efforts to inform members of our own profession and our clients. Both parties must be fully aware of the risks they take when selection is made with price as a dominant factor. Even though the lowest price is not the one selected, the quality of service and the cost and behavior of the projects to be constructed unavoidably slip into the background.

"If there were to be a general statement, I think it would have to

be that, whenever there are prices stated by two or more engineering firms a bidding situation exists which is undesirable and possibly unethical. Unfortunately, I fear that we cannot reach any agreement among the presently practicing engineers on any such statement."

#### Must Be Distinction

Leslie A. Helgesson of the Tudor Engineering Company pointed out that the layman, the average client, does not distinguish between a bid and a proposal. A proposal should be an offer to prepare engineering services to solve a client's problem, accompanied by statements concerning scope of work, qualifications, time estimate, and fee negotiations. On the other hand, a bid is a definite commitment to perform specified services for a given sum of money. A bid in the form of a proposal supplemented by written or verbal considerations may influence the choice of an engineer. Fees cannot be adequately presented in a proposal as it is not feasible to classify projects into firm categories or determine the complete scope of the work. All projects are not related to construction cost.

Helgesson discussed the four methods of determining fees—fixed, cost-plus, cost-plus with upper limit, and fees based on construction with fixed and cost-plus factors. He said fee determination should be part of the negotiation procedure, not part of the proposal. If a fee is requested in the proposal the proposal becomes a bid. A proposal on a purely price basis, regardless of qualifications, experience, equipment, and availability of manpower and talent, constitutes a bid. A proposal which belittles the qualifications of another engineer, is solicited on a basis of political favoritism, or seeks to void an awarded contract, is unethical.

By keeping Defense department and other public bodies informed about unethical practices and a

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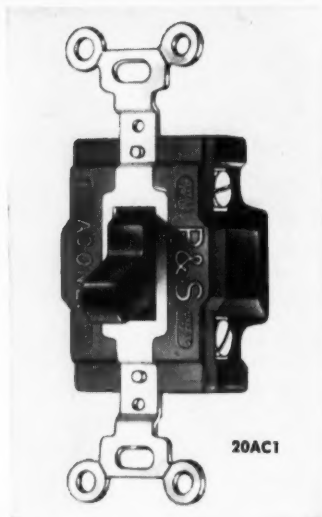
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School officials are becoming increasingly aware of the close relationship between peak learning efficiency and correct comfort level. With the Nesbitt System, you offer school administrators the opportunity to upgrade academic achievement through controlled classroom climate. And, with Nesbitt, you can show savings of 20% or more on construction, installation and equipment costs.

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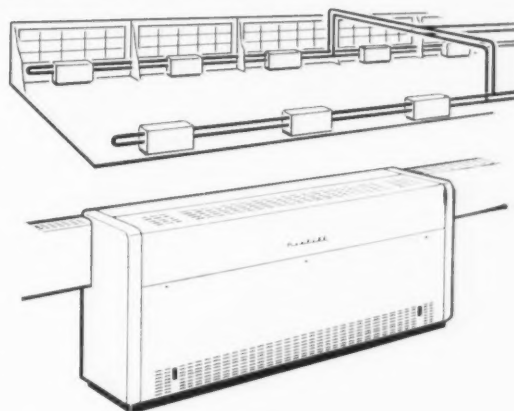
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continuing program of education of engineers, bidding can be discouraged, said Helgesson. He cited one example where a city official requested bids for engineering work. Acting in concert, every engineer answered with a letter stating qualifications. Helgesson also warned against contingent fee requests for feasibility studies where no funds are available.

In the discussion period, John Sardis, San Francisco consulting engineer, mentioned the need for educating public officials since they are among the worst bid-requesting offenders, and some members of public bodies have no experience in negotiating for engineering services. But, it was answered, some public agencies only pretend ignorance—most are fully aware of what they should do in negotiating contracts for engineering.

#### Oregon Meeting

After a discussion by Carl E. Green, Rowland S. Rosé, and

Thomas R. Miles, the Consulting Engineers Association of Oregon suggests eliminating the word "proposal" in relations between client and engineer because there are too many commercial connotations associated with the word. Suppliers and manufacturers continually submit "proposals," and the term implies money or fees instead of capability and performance—which should be dominant factors in selecting an engineer. The term "proposal" should be supplanted by a term like "synopsis," "syllabus," "prospectus," or perhaps "professional proposal."

Discussing proposals relating specifically to products and processes, Miles said that it was comparatively simple to avoid them.

"We not only do not approve of proposals, we don't make them. Since the scope of work, and therefore the fees, usually cannot be established by negotiation without further knowledge, we suggest, and insist if necessary, on a study of

the project to establish what should be done (scope); approximately how to do it; a rough cost estimate of the entire project; and a preliminary evaluation of the results expected.

"This study is done for a flat fee and includes, as part of the cost estimate, an estimate of engineering and supervision. In these specialized fields, the study enlightens both the engineer and the client, clarifies duties and responsibilities, establishes feasibility in most cases, and provides a chop-off point for either party. It really works, but is hard to apply in the more conventional fields that operate on a percentage or fixed methods of establishing fees," Miles conceded.

#### Not Compulsory

Green mentioned that some courts have decided there is no necessity for competitive bidding for engineering services even when municipalities have requirements in their charter demanding it. When an engineer submits a letter or discusses a project with the owner, he should spell out the services the engineer is going to perform and spell out the services the owner is to supply.

Green mentioned that many clients have no idea how to select a professional engineer. "Some clients," he said, "believe our services are purchased like potatoes."

The verbal method of submitting a proposal is very risky, said Rosé. A brief letter of intent is a reasonable method if you are sufficiently sure of the people you are dealing with. The formal contract, a complete document, is the most trustworthy if protection of your own interests is required.

#### New Publication

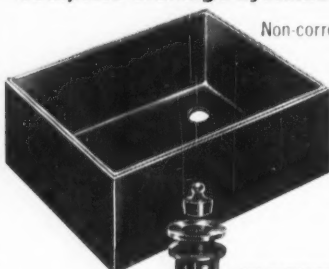
The association now is publishing a 10-page periodical, with J. Donald Krocker of J. Donald Krocker & Associates, editor, and Ralph Roderick of Cornell, Howland, Hayes & Merryfield, assistant editor. ▲▲

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*Super-Seal* motor superiority results from two distinct revolutionary insulating techniques. Available in any integral horsepower size, smaller *Super-Seal* motors incorporate a *Poxeal* stator. A durable epoxy resin encloses the stator, creating an electrical system impervious to outside elements.

In larger sizes, *Silco-Flex* insulation is used. In this system, silicone rubber is vulcanized into a homogeneous mass to form a flexible, moisture and heat resistant, void-free dielectric barrier around coils and leads.

Both of these insulation systems are unsurpassed. Proof? An encapsulated motor ran for hundreds of hours at full load in a 4% brine solution.

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## New open motors are unaffected by moisture and contaminants

**Modern** insulating materials and new methods of application, now available in *Super-Seal* open-type motors, are drastically changing motor application standards. These insulations are so completely impervious to moisture and contaminants that *Super-Seal* open motors can be used in most applications formerly requiring costly enclosed designs. Existing applications have resulted in savings as high as 60%.

### Basic insulation systems

Larger *Super-Seal* motors with form-wound stator coils use the *Silco-Flex* insulation system. Heart of this system is a remarkable rubber-like silicone elastomer, applied in semi-cured state and vulcanized to form a void-free, impervious dielectric barrier. More than four years of development and field testing have proven the superior electrical and physical properties of *Silco-Flex* insulation systems.

Stator coils of smaller random-wound motors are protected by equally effective *Poxeal* insulation system. A tough, durable case of epoxy resin completely seals the winding end turns and slot portions. Bonded to the stator laminations,

it forms a seal completely impervious to contaminants.

### Moisture resistance

In addition to being void-free, the silicone elastomer used in *Silco-Flex* insulation is moisture repellent. Even in high humidity, moisture does not form a surface film of condensation. Coils with this protection can operate completely immersed in water. In fact, one of the recommended cleaning procedures is use of detergent and water.

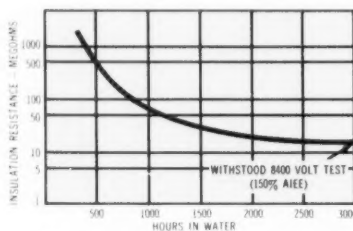


Fig. 1—Test curve shows insulation resistance of *Silco-Flex* insulation while immersed in water.

Moisture resistance of *Silco-Flex* coils is demonstrated in Fig. 1. After more than 3000 hours of total immersion with 2300 volts impressed on the coil, the test was terminated when it became apparent that

little more drop could be expected in the coil's insulation resistance. At that point the coil still withstood a high potential test of 8400 volts without injury.

Encapsulated stator windings are equally well sealed. Motors with *Poxeal* insulation protection have been thoroughly tested under water while operating with full load and full voltage.

### Resistance to contaminants

Silicone elastomers and epoxy resins are relatively inert to attack by practically all reactive agents. Further, the void-free construction of insulation systems used in *Super-Seal* motors prevents penetration of contaminants. As a result, *Super-Seal* motors are unaffected by oils, most acids, salt solutions, alkalis, and oils and are ideally suited for such applications.

### Thermal stability

Temperature-wise, *Silco-Flex* insulation can easily withstand hot-spot temperatures of 200 C and more—

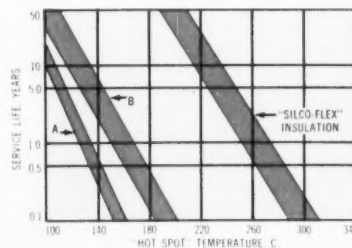


Fig. 2—Chart shows that *Silco-Flex* insulation more than meets Class H requirements.

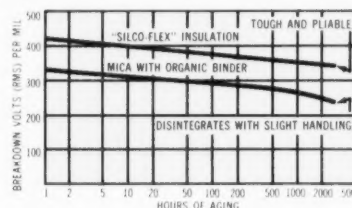
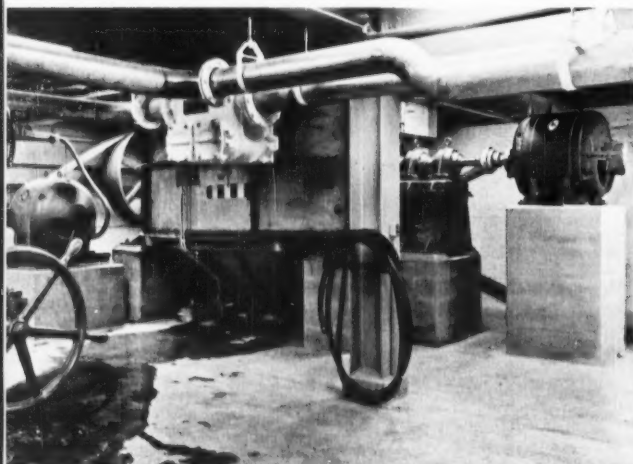


Fig. 3—Tests of 2300-volt insulated bars show thermal stability of *Silco-Flex* insulation.



Paper mills have wide application for *Super-Seal* motors because of moist atmospheres.



easily meeting Class H temperature requirements (Fig. 2). At temperatures where the life of Class B coils would be measured in weeks, the life span of *Silco-Flex* coils is well beyond machine obsolescence.

Comparison with a mica-organic binder insulating system (Fig. 3) offers further proof of thermal stability. After 2000 hours of aging at 200 C with 8500 volts applied continuously, the *Silco-Flex* insulated coil was still tough, pliable, and completely serviceable. The mica-taped insulation had deteriorated to the point where it disintegrated readily and was completely useless.

An added advantage of *Silco-Flex* insulation is unusually high thermal conductivity — about twice that of conventional insulations. This means heat dissipates faster from its point of generation.

*Poxeal* insulation also demonstrates remarkably good thermal stability. Materials now in use are suitable for Class B temperatures, although actual classification of the insulation is determined by the basic material used.



**Fig. 4**—Samples of motor insulations after sandblasting give comparison of abrasion resistance.

#### Abrasion resistance

Resistance to abrasion is still another point of superiority in the insulation systems used for *Super-Seal* motors. Abrasion resistance of *Silco-Flex* insulation is compared to other types of insulation in Fig. 4. After one minute of sandblasting with 90-grit aluminum oxide and 100-psi air, only slight surface erosion appeared on the *Silco-Flex* sample. Other insulations were eroded to bare copper.

#### Application practices obsolete

The superior qualities of *Super-Seal* insulating systems, developed by Allis-Chalmers, make it necessary to reappraise present application practices. With virtually ageless insulation, *Super-Seal* motors assure more reliable service and require less upkeep than the best protected, conventionally insulated machines — and at considerably less cost.

*Super-Seal*, *Poxeal*, and *Silco-Flex* are Allis-Chalmers trademarks.

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Cost and superior insulation aren't the only reasons. Users are getting MORE MOTOR, too. Here's why:

Standard totally-enclosed motors, 55° C rise, have a service factor of 1. In other words, "nameplate" horsepower is the maximum. A 40° C rise *Super-Seal* motor with *Poxeal* insulation, and a 60° C rise *Super-Seal* motor with *Silco-Flex* insulation have a service factor of 1.15. For comparisons on what this difference means in required motor sizes, see this chart:

Rated Horsepower (Maximum Hp, TEFC)	Maximum Continuous Hp— <i>Super-Seal</i> Motor
15 hp	17.25 hp
25	28.75
40	46
75	86.25
125	143.75
200	230
350	402.5
500	575

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Voltage \_\_\_\_\_

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Power factor \_\_\_\_\_

Starting torque \_\_\_\_\_

Pull-in torque \_\_\_\_\_

Pull-out torque \_\_\_\_\_

### Application Data

4. Description of application:

5. Drive: Direct-connected ☐

V-Belt ☐ Other: \_\_\_\_\_

Starting load \_\_\_\_\_

Ambient temperature \_\_\_\_\_

6. Operating conditions:

Dirty ☐ Clean ☐ Wet ☐ Dry ☐

Other \_\_\_\_\_

### Information on Existing Motors

(for comparison)

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Type of enclosure \_\_\_\_\_

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# ALLIS-CHALMERS



# Atoms in Action

JOHN F. LEE

Broughton Professor of Mechanical Engineering  
North Carolina State College

The Year 1958—  
and a Glance into the Future

ON THE WHOLE, 1958 was good to us in the United States and the bounty of that year should make us optimistic about the future. It was a year of scientific progress and awakening to the fact that the safety of the nation does not depend on the political proclivities of the common man so much as on the contributions of intellectualism. The past year witnessed the condemnation of conformity and the elevation of the independent thinker even to the point where Madison Avenue exploits his popularity in the advertising of cigarettes. The past year saw recovery from a panic which could have transformed our schools and colleges into institutions devoted to the training of specialized robots. We now have a clearer picture of the inadequacies of our educational institutions and realize that leaders must be educated before they are trained as scientific specialists.

The power of intellectualism was felt even behind the iron curtain where despotic leaders could not entirely enslave the free spirit of their Pasternaks and scientists. Indeed, there is evidence of a fearful realization on the part of communist leaders that their safety rests more on the toleration of intellectualism than on the power of a proletariat drilled to conformity. Russia's grudging acceptance of scientific and cultural exchange offers evidence of her need to pamper intellectualism. This is hopeful, for we know that true intellectualism cannot be bought; eventually it will assert itself in bold terms that despots can neither defy nor avoid.

The successful launching of American earth satellites, the revelation of progress in the peaceful uses of fusion energy by Great Britain and the United

States, and the Geneva Conference on the Peaceful Uses of Atomic Energy were great accomplishments of 1958. These scientific accomplishments strengthened the spirit of free men throughout the world.

The year that lies ahead offers an unparalleled challenge, which has special meaning for engineers and scientists. More than at any time in history engineers and scientists must observe the impact of their accomplishments on the fate of humanity. This does not mean that these men should occupy an elite position in our society in which they are accorded a power of clairvoyance not given to other leaders. It does mean that engineers and scientists will have a special obligation to evaluate and interpret their works and to share with all other men decisions as to the wise utilization of these works.

## Four Big Challenges

Some of the obligations which must be met by engineers and scientists are:

1. The need to meet the threat of Soviet technical assistance programs by means of a grass roots program for the participation of American scientists and engineers of the highest caliber in the development of underprivileged nations. The participants in this program would be scientific missionaries analogous to religious missionaries. Such a program would have benefits which cannot be matched by government sponsored programs.

2. The need to defend education beyond the short-term objectives of producing more engineers and scientists. Already there is evidence of pressure being exerted on the Congress to use Federal fellowship programs as a pork barrel for mediocre

# RUBBER and VINYL SEALS

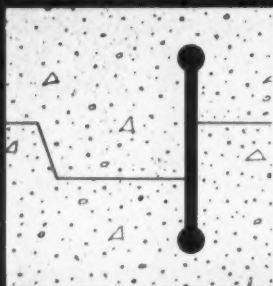
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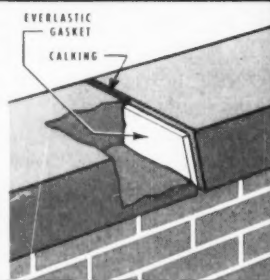
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## WEATHERTITE for CONTROL JOINTS



Weatherlite is a specially shaped, nonporous, expanded Polyvinyl Chloride strip which provides multiple, continuous contact surfaces when compressed, and thereby produces the positive pressure contact essential for an effective watertight seal in standard control joints in block constructed walls. Weatherlite is available in two types to meet all requirements. Type "R" is made especially for use in Michigan Control Joints; Type "RB" is made especially for use in Besser Control Joints.

See Sweet's Files, or Write for Information.

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or underprivileged institutions. There are pressures to provide for allocation of fellowships on a regional basis or to spread them among many mediocre schools rather than allow the fellow to select the best schools. Indeed, underprivileged institutions which offer promise of achieving eminence should receive financial assistance immediately but the fellowship program is hardly the vehicle to accomplish this objective.

3. The need to evaluate and advise on the huge expenditures for research and development being appropriated by Congress rests squarely on the shoulders of engineers and scientists. Do these large appropriations impose competing demands on scarce resources with the result that too much talent is diverted to applied research to the detriment of basic research and education? Is the present administration of government research programs sufficiently broad in outlook to see the whole research picture or is it blinded by the needs of a particular agency or service? These are big questions which can be answered only by engineers and scientists who have no sworn allegiance to a particular branch of government.

4. The need for unity of the profession of engineering must be met by engineers. Besides the fragmentation of the profession along the lines of specialties, engineers have been too prone to leave the affairs of their societies in the hands of a benevolent autocrat in the person of the executive secretary. Officers are elected as temporary titular heads but their tenure of service leaves the scene unchanged. The organizations are so inflexible that they encourage the formation of new societies — by those who wish to be heard or have new scientific interests. If this process continues it is inevitable that the mother societies will be emasculated to the status of London social clubs. Even more important, there is no clear expression of the judgment of the engineering profession on such matters as legislation or even the standards for accreditation of engineering schools.

### What the Future Holds

These are only a few of the challenges facing engineers and scientists during the coming year. But the opportunities are equally stimulating. Mr. Frederick Kramer of Public Service Electric and Gas Company has put some of these opportunities in very cogent terms. "An ocean of expansion lies ahead of the American people with energy delivered from the sea. Instead of worrying about dwindling fossil fuel reserves and radioactive nuclear plants, power engineers will be able to supply this country with free hydrogen fusion power from sea water. Americans will be able to have an almost completely automated life at low cost. All



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When a recent visitor to our plant saw a section of the new Guth Prismoid-GrateLite lying flat on white paper, his eyes sparkled.

He held it up and exclaimed, "It's great! It's got holes!"

Our visitor was a ballast salesman, and he was mighty happy that the gorgeous new Prismoid has holes. As he explained, almost everyone is enclosing ballasts, cooping up the heat, cutting down fixture depth... making it tougher than ever for ballasts to serve their legitimate lives.

But here is Prismoid, a prismatic louver-lens *with holes!* The ballast salesman said, "It's certainly a step in the right direction!"

Thanks to Prismoid's *breathing action* ballasts get ventilation, lamps are cooled and the flowing air helps keep lamps, Prismoid and fixtures up to 50% cleaner than solid panels.

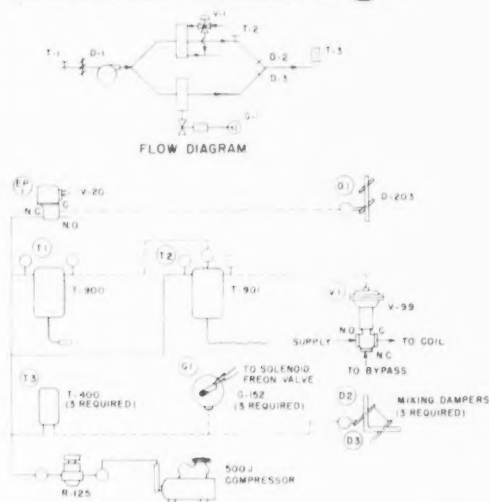


**PRISMROID**  
• **GRATELITE**  
The Prismatic Louver-Lens

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this will take place before the end of the century. Controls at an easy chair could control the mechanisms to warm our swimming pools, cook our meals, wash the dishes electrostatically, dim the luminescent walls, and consult an electronic memory so that we would never forget a complete shopping list or overlook a social or business obligation. One room of the house might serve as a part-time office with electronic access to all sorts of data. Much of industry would be automated, and the ability to provide extensive artificial lighting could make the day as long as necessary to complete field jobs.

"In transportation, electric energy should in some way succeed petroleum as the energy source on our highways. New high-speed safety will be possible with radar devices.

"The utility company that supplies all the power for these devices will be a desirable neighbor, clean and quiet in operation. No huge loads of fuel will be burned, thus eliminating dirt and soot. All its power source will be contained in a tank of water. The power engineer's job in this society will be to perfect the methods and create new plans. As automation spreads, his responsibility in sound design, construction, and operation will increase enormously.

"The first steps toward these goals are now being taken. Nuclear fission is stopping the gap until the advent of hydrogen fusion and providing better quality of service to the community. One can fairly feel the growth and observe the trends to things that are bigger, faster, lower cost, and more reliable. The full realization of our opportunities can and should be within the career of today's young engineer. This is the promise of the power industry."

New frontiers in engineering are opening in many other fields. Nuclear aircraft propulsion, rocket transport of freight across the Atlantic in 12 minutes, the chemical or electrical storage of solar energy, disposal of radioactive wastes, industrial uses of radioisotopes, thermoelectric devices for heating and refrigeration, irradiation of food for preservation, and manned space vehicles are opportunities and challenges which delight the engineer working at the frontiers of engineering knowledge.

This year will see progress in many of these areas, and many of the challenges undoubtedly will become routine engineering tasks in the years to come. New industries will be formed to produce new products and services related to the new discoveries. Older industries will be transformed to meet the needs for these new products and services. To fail in an awareness of the potentialities of the frontiers today could mean failure to survive professionally tomorrow. ▲▲



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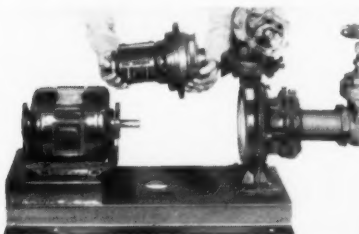
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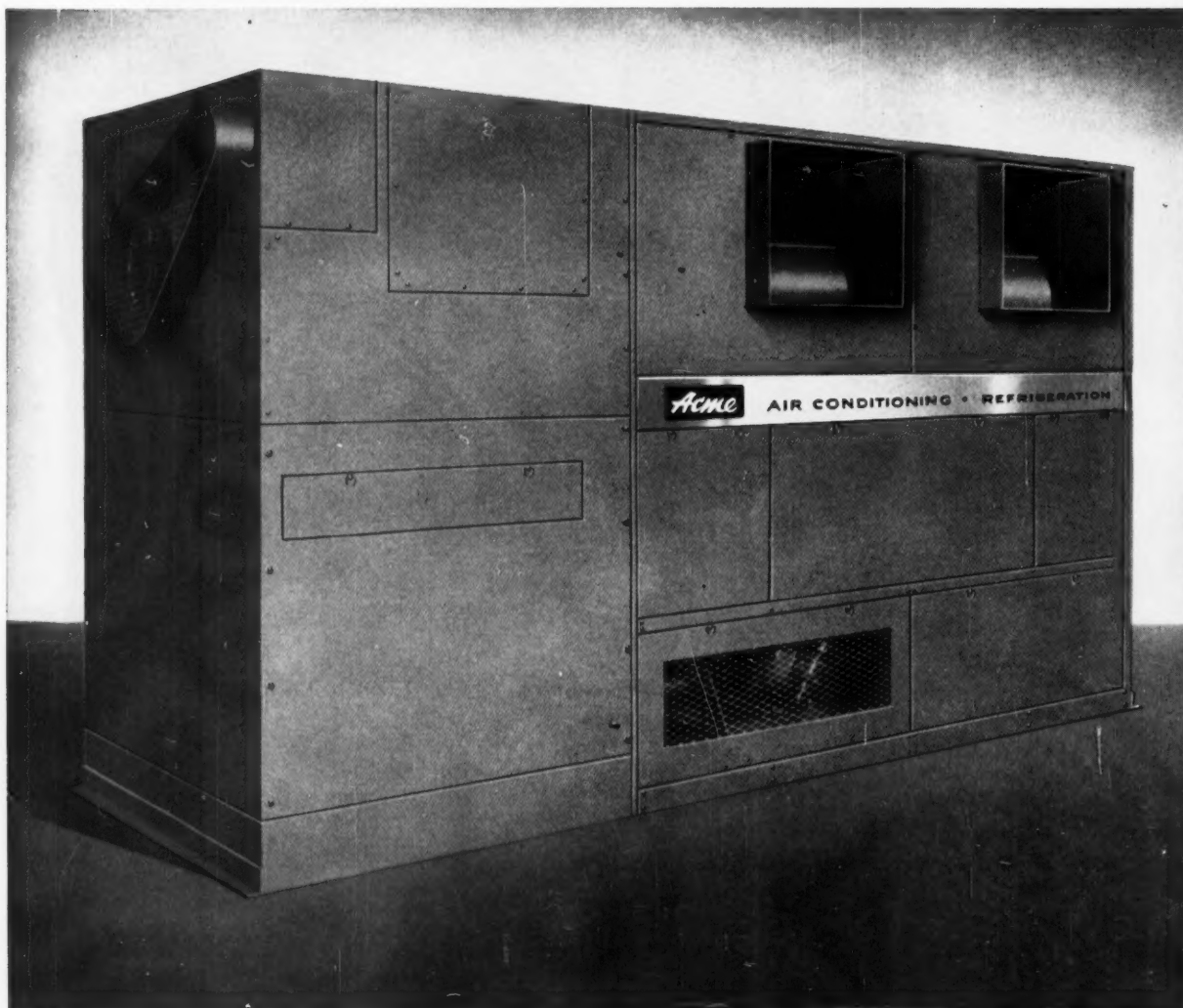
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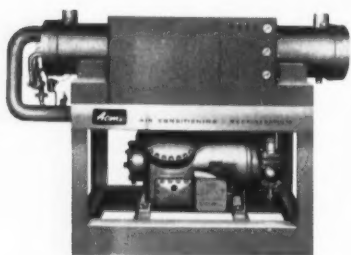
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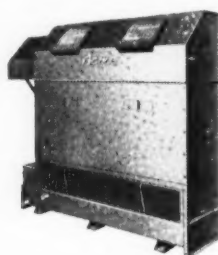
... the **practical** approach to air



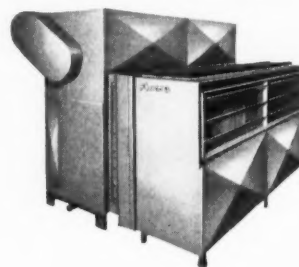
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For complete information on the new Acme Packaged Air Conditioner, call your local Acme sales engineer or write to the factory.

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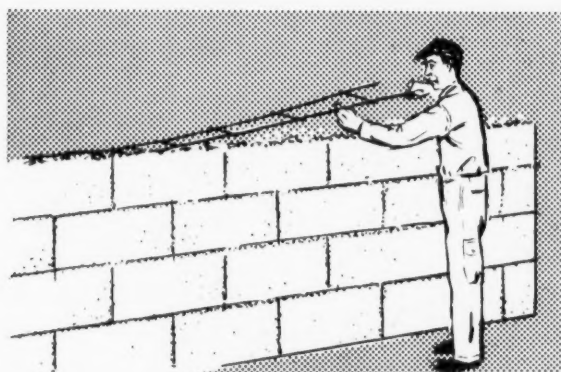
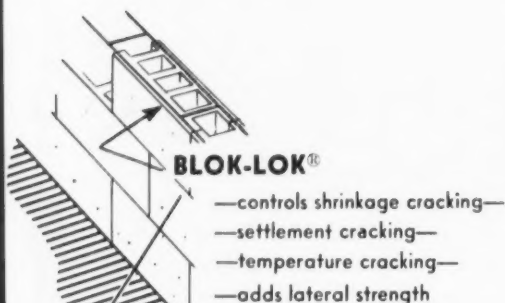
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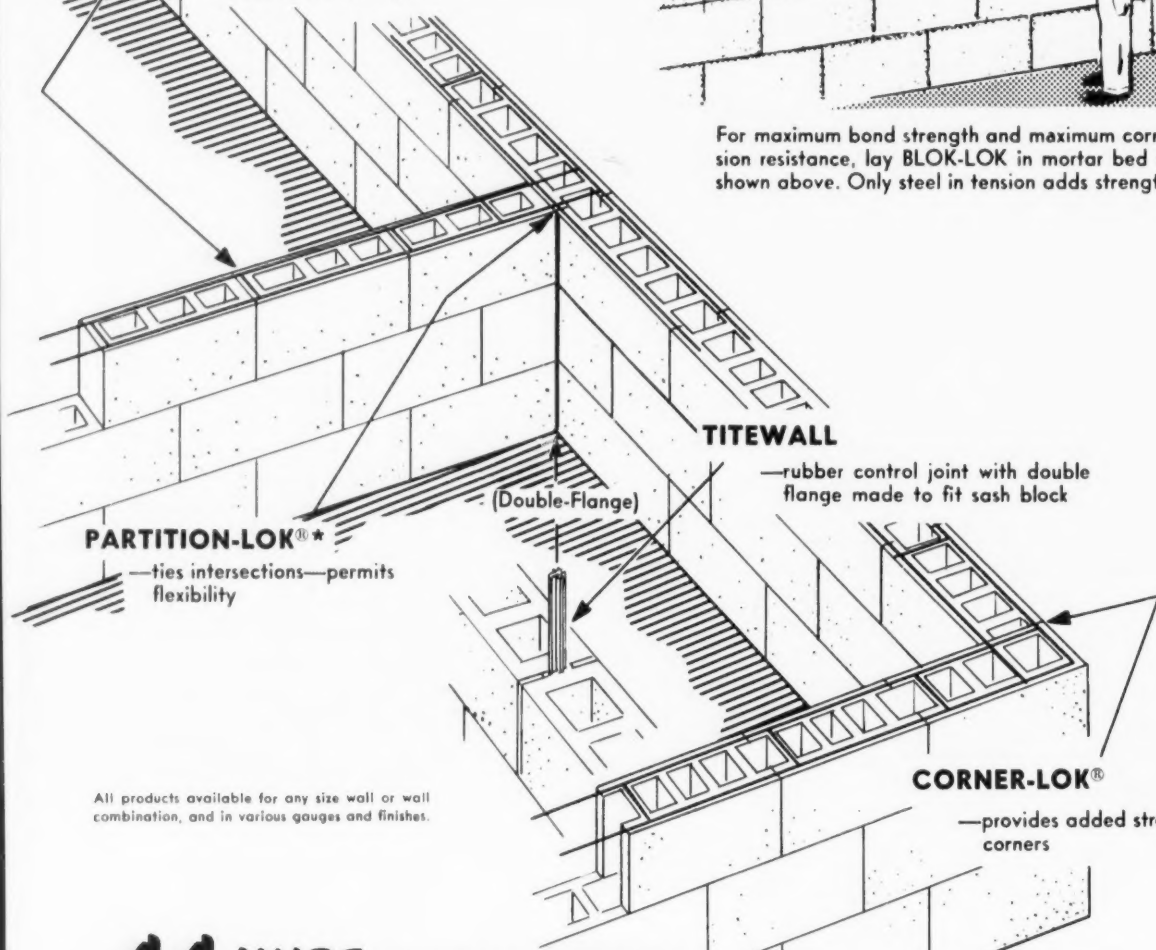


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Thermal compensating groove prevents distortion when welding valve in line and permits perfect seating of disc for positive seal.

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# A Portrait Of The Profession--1959

A Staff Report of a Survey of Consulting Engineers



**C**Exclusive DURING THE PAST FEW MONTHS, nothing has so much interested the consulting engineer as the way in which other consulting engineers operate their firms. The increased membership in consulting engineer associations and functional groups has made it possible for some information on this subject to be exchanged, but not nearly enough data have been collected to make it possible for one firm to measure itself accurately against any acceptable yardstick.

In an effort to make possible a logical comparison, CONSULTING ENGINEER has conducted a survey among its readers. The results provide a basic pattern alongside which each firm can study its own operations to see where it matches and where it varies from the typical. The average could not be expected to correspond exactly to any actual firm. Every firm is either larger or smaller, broader or narrower, than the average, but after adjustment is made to compensate for these differences, a firm should be able to see where it closely resembles and where it widely differs from the average in its organization and operation.

## The Sample

In computing the data used in plotting this pattern of office organization and operation, a 1000-firm sample was used. The answers from the 1000 questionnaires were punched onto IBM cards, and all sorting, averaging, and computing were handled on punched-card equipment.

Of the 1000 firms in the sample 77 percent are independent consulting firms dealing only in engineering services. Some of these firms do have employee architects on their staffs, but all partners and principals are engineers. About 15 percent of the 1000 firms are engineer-architect or archi-

tect-engineer firms in which there are both engineer and architect partners or principals. All of the data from these firms have to do with their engineering departments only. No architectural department figures are included in the results. The remaining 8 percent are engineer-constructor firms, and here again, results reflect only the activities of the engineering department; all construction department activities are excluded. Consequently, this survey represents organization and operation of engineering groups only — architecture and construction are in no way involved.

## Types of Engineering

To get a clear picture of the various activities of the individual firms answering the questionnaire, it is important to know the types of engineering work in which they are engaged. As indicated in

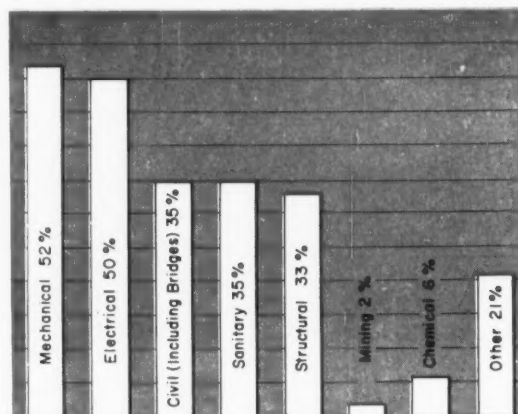


Fig. 1—The percentage of consulting firms that engage in each of several branches of engineering.

Fig. 1, mechanical engineering is the largest single field by actual number of firms involved, about 52 percent of the firms answering offering mechanical engineering services to some extent. Electrical is just slightly behind with exactly half of the firms reporting that they do this type of work. Civil, sanitary, and structural follow with about a third of all firms engaged in each of these branches. Chemical and mining are rather low so far as numbers of firms are concerned, but "other" is fairly popular, with about a fifth of all firms offering special services such as rate studies, machine design, city planning, traffic and transportation studies, and a multitude of other miscellaneous engineering activities.

### Multiple Fields of Endeavor

Since these percentages total much over 100, it is obvious that many firms engage in more than one branch of the profession. As shown in Fig. 2, there are as many engaged in three branches as there are those in just one, while two is the most popular of all, with almost a third of all firms falling into that category. The percentage of firms drops when we get to four or more fields of activity, but it must be remembered that these are, for the most part, the larger firms and therefore represent a greater share of total work than these figures would imply.

An analysis of the returns showed 88 separate combinations of branches among the 1000-firm sample. The most popular combination, as might have been guessed, is mechanical-electrical. Other popular combinations are mechanical-electrical-sanitary; civil-structural; civil-sanitary; and even mechanical-electrical-civil-sanitary-structural, a five-branch combination that covers almost any type of engineering service from highways to hospitals.

### Average and Median

If all of the firms are taken together, the average size of staff is 21. This does not, however, give a very well focused picture, for it is based on a simple arithmetic mean. The median figure gives a sharper picture, showing a staff size of 8. This means that there are exactly as many firms with more than 8 on the staff as there are with less than that number.

Fig. 3 shows that 39 percent of the consulting firms in the country have five or fewer employees; 23 percent have 6 to 10; and 21 percent have 11-25. Going upward from here, percentages decrease rapidly until we see that only 3 percent have over 100 employees. However, this 3 percent accounts for a huge 41 percent of the total staff employed by all the firms in the country. The smallest firms, those in the 1-5 staff group only employ 6 percent of the total. This means that there are about 13 times as many firms in that smaller group as there are in

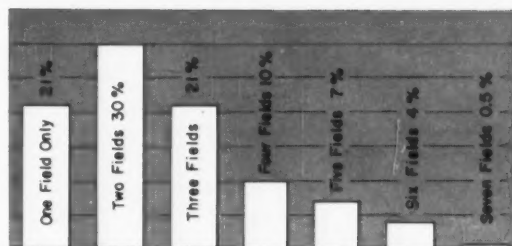


Fig. 2—The percentage of consulting firms that engage in one or more branches of the profession.

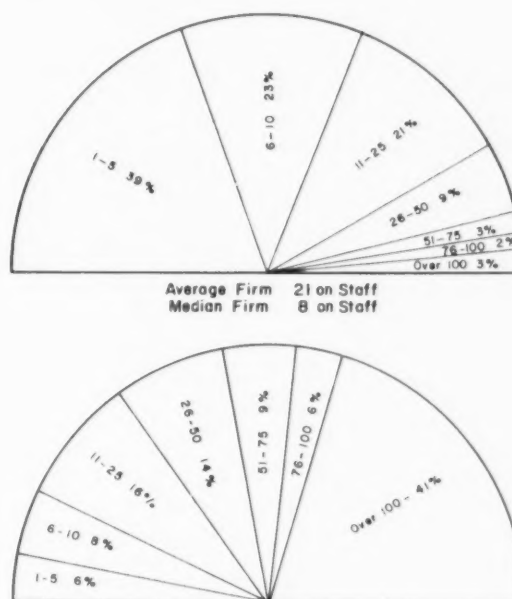


Fig. 3—Top chart shows percentage of firms in each of several staff size groups. Bottom chart shows percentage of total personnel employed in each group.

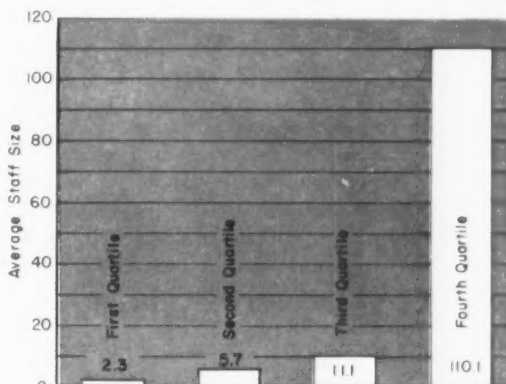


Fig. 4—Bar chart indicates average staff size of consulting engineer firms in each size quartile.

the 100 and over group, but this large firm group, while including only a few firms, employs almost 7 times as many people.

Fig. 4 continues to illustrate staff size by separating the sample into quartiles. Note that the average staff even in the third quartile is low, coming to only 11.1 persons; then there is a large jump in the fourth quartile to an average size of 110.1 on the staff. Here again we see demonstrated the fact that the upper quarter of the firms (the top 250 in the 1000 sample) account for a disproportionately large number of the total of all persons engaged in consulting engineering work.

#### Staff Breakdown

We have seen that the median firm (the 500th firm in the 1000 firm sample) has 8 on the staff. This staff is made up of 1.7 principals, 2.4 registered and responsible engineers, 1.7 draftsmen, and technicians, 1.1 nontechnical administrative, and 1.1 clerical and miscellaneous. Compare this with the breakdown on the average size firm in the upper quartile—the firm with 110 on the staff. This firm has 6 principals, 39 registered and responsible engineers, 43 draftsmen and technicians, 10 nontechnical administrative, 12 clerical and miscellaneous.

#### The Composite Firm

Another way of looking at the profession is through an examination of the composite firm. The composite firm is the firm that would exist if all the consulting engineers in the country were to join together into one great firm. By studying the organization and operation of this huge theoretical organization we get a perspective of the profession as a whole, a picture that goes beyond the simple averaging of firm against firm, large or small, and instead takes into account the size of each firm and its proportionate influence on the composite whole. With this we can see what kind of work the whole

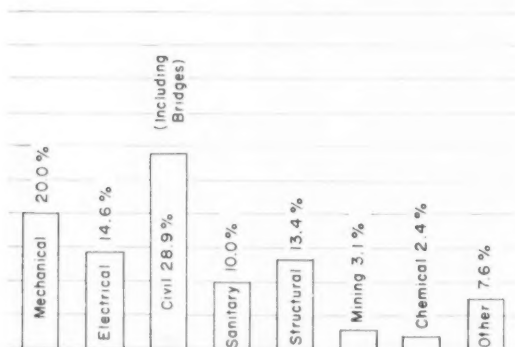


Fig. 5—Percentage of work done in each branch of the profession based on a composite of all firms.

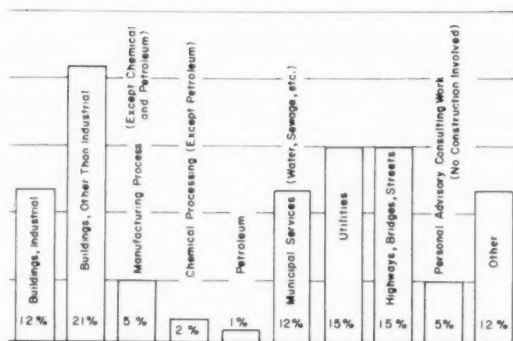


Fig. 6—Percentage of work done in each of several fields based on composite of all consulting firms.

profession is doing, who it is working for, and how it functions.

Looking at the whole profession this way, we find that it is engaged in all branches of engineering to the extent shown in Fig. 5. The largest percentage of the work is in civil (28.9%), followed by mechanical (20%), electrical (14.6%), and structural (13.4%). Note that this does not mean that 28.9 percent of the firms are civil firms but that in the entire profession, 28.9 percent of the total man-hours go into civil engineering activity.

The work done by the composite firm also can be broken down into specific fields of activity. This is shown in Fig. 6. Note that the highest percentage of the work done by the entire profession is in buildings, with nonindustrial amounting to about 21 percent and industrial to about 12 percent. Note also that municipal services, utilities, and highway work account for a large share of the total.

Then there is the question of where most of the work comes from. Fig. 7 shows that this composite firm gets 45 percent of its work from private clients, 37 percent from government, 16 percent through architects, and 2 percent through other consultants.

Again it is necessary to remember that these figures indicate the sources of all the work done by consulting engineers in this country. We might say that these percentages show the percentage of man-hours given to work from the several types of clients. But while 16 percent of the engineering work comes from architects, it must be remembered that more small firms work for architect clients than do large firms, so a great deal more than 16 percent of the firms have architect clients. (Actually, over half do some work for architects.)

#### Research by Consultants

Many consulting engineers complain that they are pushed so hard by deadlines that they have almost no opportunity to do any research work not direct-

ly connected with a specific project. On the average, however, all the firms, large and small together, say that they give about 11 percent of their time to independent research. That is a very healthy slice of their total to give to work that does not provide any direct monetary return. There are not many manufacturers in the country that give as much of their time to research.

When the total sample is broken into quartiles, we find a striking difference between the large and the small firms. Fig. 8 shows that the lower quartile averages only 3.2 percent of their time given to independent research, while the top quartile averages 25 percent of their time in this nonassignable investigation work not directly connected with any particular project. This implies that the larger firms are carrying more than their share of the research load. This is understandable, but it indicates one weakness of the small firms that they should seriously consider.

### Phases of Work

Most consulting engineers can break their work down into three phases: preliminary, design, and supervision of construction. There is also another separate but important type of work: personal advisory consultation not involving construction. This survey shows that about 11 percent of the average firm's time is given to this personal consultation. Separating this type of activity and considering only that engineering work connected with construction projects, we find that the average project (if there is such) involves 20 percent of the total time in preliminary, 61 percent in the design phase, and 19 percent in supervision of construction. This differs considerably from the percentages suggested by most fee schedules, where it is common to recommend 5 to 15 percent of the fee for preliminary, 50 to 60 percent for design and 35 percent for the construction phase. Based on the averages determined

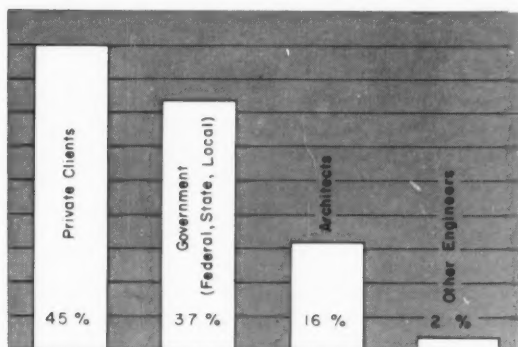


Fig. 7—Bar chart shows the percentage of work from each type of client for the composite firm.

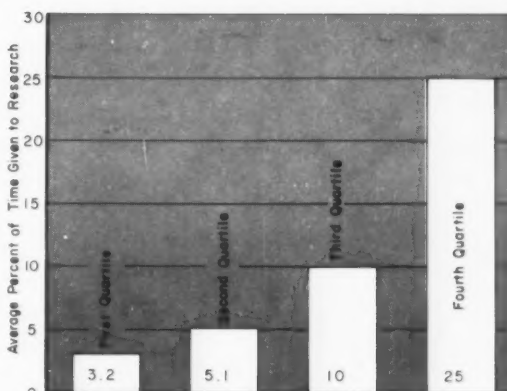


Fig. 8—Percentage of staff time devoted to independent research by quartiles based on staff size.

in this survey, it would seem more logical to assign a larger percentage (about 20%) to preliminary and considerably less than the current 35 percent to supervision of construction. Of course, the proper division of the fee among these three phases will vary somewhat according to the type of work, but fee schedules, too, must be set up on the assumption of an average project, and this study suggests that some changes should be considered.

It is well known that some engineers are using low fees for preliminary work as a sort of bait to catch clients. Certainly fee schedules should be set up to discourage rather than encourage this type of speculative activity.

### Engineering Work by Client

On the average project, how much engineering work such as advance study, scoping, criteria development, and liaison is done by the client and his engineers instead of by the consultant? The answers to this question indicate that on the average project, 17 percent of the total is done by the client rather than the consultant. Undoubtedly, this varies considerably according to the type of work and the branch of engineering involved. The questionnaires will be segregated according to types and branches of engineering and each type and branch analyzed separately. This data will be published in later articles in this series, and there may be considerable variations not only in this figure but in many others when civil, mechanical, electrical, and other branches are studied individually.

### Dollars and Cents

The next in this series of reports on organization and operation will deal primarily with fees and finance and the way in which the consulting engineer disperses his firm's income. ▲▲



## Can You Account for the Top Men's Time?

WILLIAM W. MOORE and RICHARD C. MCGOWAN

Dames & Moore

**CE exclusive** WHETHER A CONSULTING engineering organization is a small, one engineer-owner office or a large, multiple office partnership or corporation, the proper utilization and control of its man-hours is vital to its successful operation. The consulting firm provides the talent and experience of its engineering minds, which, for business purposes, may be measured to a great extent in units of time.

The manager concerned with the over-all direction of a consulting organization knows that the cost of this time is the predominant expense of his business. He knows that a certain proportion of the time must be spent on job work in order for the organization to be financially profitable. Yet this manager will sometimes neglect to account for the time of principals of the organization. In a partnership or sole proprietorship, the consequences of this neglect may be serious, ranging from an inferior and costly application of a principal's time, to the financial failure of the business as a result of inadequate profits.

### The Necessity for Accounting

It is important to account for the principal's time for two fundamental reasons: to know how his time

is spent; and to include the cost of his time as an expense of doing business.

A principal in a consulting firm usually has heavy demands on his time—sometimes more than he has hours or energy to handle. Primarily among these demands are those that call for the use of his engineering knowledge and those that make use of his talents as a developer of new business. These time requirements alone frequently would consume the normally accepted work week, yet the principal commonly has other important responsibilities. He often is contributing an appreciable amount of time to his profession through participation in professional societies and associations, many times as an officer or a committee member. He may have managerial duties, particularly in the smaller organization where a principal must participate in every aspect of the business. And the personal characteristics which lead him into private practice often lead him to accept heavy civic responsibilities.

Clearly, if the principal is to meet these demands, he must plan well and be extremely discriminating in the use of his time. He knows that if he assumes too much of a burden he may not be able to discharge any of his responsibilities ef-

fectively. It is important, therefore, that he be provided periodically with a picture summary that shows how he spends his time. Only this way can he determine a proper time pattern.

Too often no cost is assigned to the time of a principal. This condition has been fostered to a considerable extent by Federal income tax provisions. A sole proprietor cannot pay himself a salary and deduct it as a business expense for tax purposes, and the same procedure usually is followed in partnership accounting (although guaranteed payments to a partner are permissible since passage of the Internal Revenue Code of 1954.) In addition, the accounting systems of some consulting engineering organizations must, even at best, be called primitive. Sometimes the function of accounting is limited to providing the minimum data needed to produce the required tax and information returns.

Unfortunately, straight "tax accounting" does not furnish all the information needed for the intelligent management of a business enterprise. An example will illustrate the point. Consider A & B, Consulting Engineers. This firm, headed by two partners, had a gross income of \$200,000 for the year. In the chart, the bar at left shows the financial results of operations on a tax accounting basis. It indicates a profit of \$20,000. The bar at right has been modified to include as a business expense a salary of \$12,500 per year for each partner. Now, instead of a profit of \$20,000, there is a loss of \$5000.

The difference in results is so marked and so elementary that it might be assumed that the point illustrated always would be borne in mind by the partners. Unfortunately, this is not always so. Too often the true profit picture of a consulting business is obscured during the course of its fiscal year, and when the year's results are accounted

for, the owners find they have deceived themselves and have by no means paid themselves an adequate remuneration for their own work.

### How to Account for Time

Accounting for a principal's time involves nothing more than a rudimentary form of cost accounting—recording expenditure of time each day, costing the time spent, and periodically reporting the results. Normally, the additional work required can be taken in stride by the existing accounting personnel, and the additional expense should be minor.

The first step in this accounting is to consider the main activities of the principal, and then to decide which should be regarded as a business expense for management purposes. Representative classifications might be:

- † Consultation
- † Client development
- † Administration
- † Professional society activities

The second step is to determine an appropriate salary for the principal. This should be based on such factors as:

- † The complexity of his customary duties
- † Experience and abilities
- † Reputation and standing in the profession

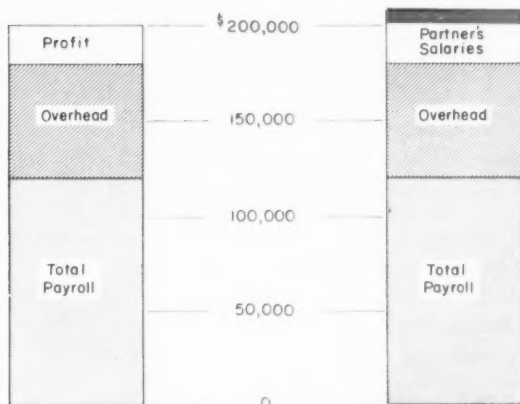
It is desirable that the salary be reasonable in terms of what he might earn as an employee of another organization.

The third step is to design and provide a form on which the principal will record the time he spends each day. A weekly record sheet, divided into days and time classifications as agreed upon, is convenient. Time should be recorded to the nearest half-hour for each classification.

The fourth step is to cost the time record—that is, to assign a cost value to the time recorded—after it has been filled out by the principal. This can be done in any one of several ways, but perhaps the simplest from a mechanical standpoint is use of a standard cost. By this method the principal's salary is expressed as an hourly rate based on an assumed typical work week of so many hours. The hours recorded on the time sheet for each classification are multiplied by this hourly rate, and the sum of the products gives the cost of the principal's time for the period.

The fifth and final step is to enter the cost obtained in the expense accounts of the business and then to report the principal's cost as a separate item in the statement of profit and loss. This should be done at least monthly, so the data can be reviewed and interpreted frequently and any required changes promptly effected.

This data is disregarded, of course, when using the accounts for tax purposes. ▲▲



Bar chart shows comparison of accounting methods.

1959



# Consulting Engineer's Economic Outlook

DR. JULES BACKMAN

Professor of Economics, New York University

*Dr. Jules Backman has served as economic consultant to the U. S. Office of Price Administration, as editorial writer for The New York Times, and as a visiting professor of economics at the University of Pittsburgh. He also has been an economics adviser to the railroad and steel industries in wage and rate disputes since 1944, and advises industry in general on wages, prices, and antitrust problems. Dr. Backman holds BCS, MA, MBA, and DCS degrees from N.Y.U. He frequently speaks to business groups on the economic outlook.*

WE ARE NOW in a period of recovery from the 1957-58 recession. It is useful to know where we are in the business cycle as a necessary prelude to determining the business outlook. Let me review briefly the experience of recent months.

Gross national product reached a peak annual rate of \$445.6 billion in the third quarter of 1957 and then declined abruptly to \$425.8 billion in the first quarter of this year. By the third quarter, the total had risen to \$439 billion. There was a continuation of the upturn in the fourth quarter. It is probable that by the end of the year gross national product was at an all-time high. However, part of this rise reflected higher prices so that the total volume of goods and services remained substantially below the 1957 peak levels.

The major part of the decline in gross national product was accounted for by a swing in inventories from a \$2.2 billion annual rate of accumulation to a liquidation rate of \$9.5 billion in the first quarter of the year. This shift in inventory policy

accounted for almost \$12 billion out of the total drop of about \$20 billion in gross national product. The annual rate of inventory liquidation was cut to \$8.0 billion in the second quarter and to \$4.0 billion in the third quarter. By the end of the year, this liquidation was substantially completed. This reduction in inventory liquidation has been a contributing factor to the recovery since last spring.

## Cutback in Plant and Equipment Expenditures

A second important factor that contributed to the recession was the cutback in plant and equipment expenditures from a peak annual level of \$37.8 billion in the third quarter of 1957 to \$32.4 billion in the first quarter of this year and an estimated \$30.3 billion in the third quarter. Recovery in the national economy has taken place since the spring months despite the continuing decline in these expenditures. Government surveys indicated a slight increase in the fourth quarter.

The reductions in inventories and in new plant and equipment expenditures were primarily re-

sponsible for the behavior of the Federal Reserve Board index of industrial production, which fell from a peak of 146 (1947-49 = 100) in February 1957 to 126 in April 1958 and then recovered to 138 in October. The magnitude of recovery in this index was held down by a number of strikes in the automobile industry.

Total construction put in place in the first 10 months of 1958 was about 1 percent lower in dollars than in the corresponding period of 1957. However, the total rose steadily between May and October after allowance for seasonal factors. In October 1958, the total was about 3 percent higher than a year earlier. However, nonresidential construction in October lagged more than 10 percent behind the rate a year earlier; public construction increased about 7 percent.

### Employment Figures

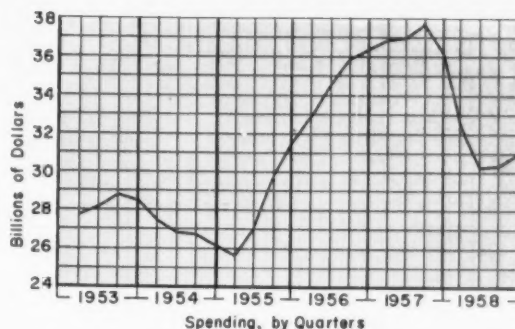
Employment during October was about 700,000 below the peak levels of a year earlier. However, total unemployment at 3.8 million, while moderately below the spring peak, is still 1.3 million higher than during 1957. The difference of 600,000 between the rise in unemployment and the decline in employment reflected the increase in the size of the labor force. The combination of rising productivity and the increase in the size of the labor force accounted for the lag in reducing the volume of unemployment.

Despite the recession, consumer incomes were well maintained and as a result total consumer spending recorded only small changes. Thus, disposable income fell from a peak level of \$308.7 billion to \$305.0 billion, or slightly more than 1 percent, and as a result personal consumption expenditures declined from \$288.3 billion to \$286.2 billion, or slightly less than 1 percent. The well-maintained level of consumer buying, except for some big ticket items like automobiles and furniture, helped to limit the decline in total economic activity. Disposable income rose to a new record level of \$314.0 billion in the third quarter, and the upward trend continued in the last three months of 1958.

### Consumer Price Index

The consumer price index in October 1958 was 2.1 percent higher than a year earlier. However, it recorded little change after March. The wholesale price index has risen about 1 percent as a result of higher food prices. Industrial prices have recorded little change since the summer of 1957 despite some increases, such as in steel and aluminum.

Despite the recession, average hourly earnings continued to rise. For all manufacturing industries the average was \$2.14 per hour in September 1958 as compared with \$2.08 a year earlier. For con-



Curve shows seasonally adjusted changes in plant and equipment spending over period of last 6 years.

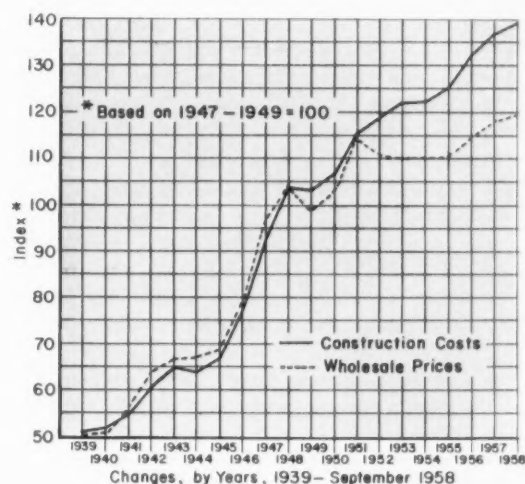
struction industries, average hourly earnings increased from \$2.90 to \$3.00 in August. The U.S. Department of Commerce index of construction costs continued to rise in 1958. In September, the index was 2 percent higher than a year earlier.

In summary, as we attempt to project the economic environment for 1959, it appears that the recession reached its low point last April and that recovery has been taking place since then.

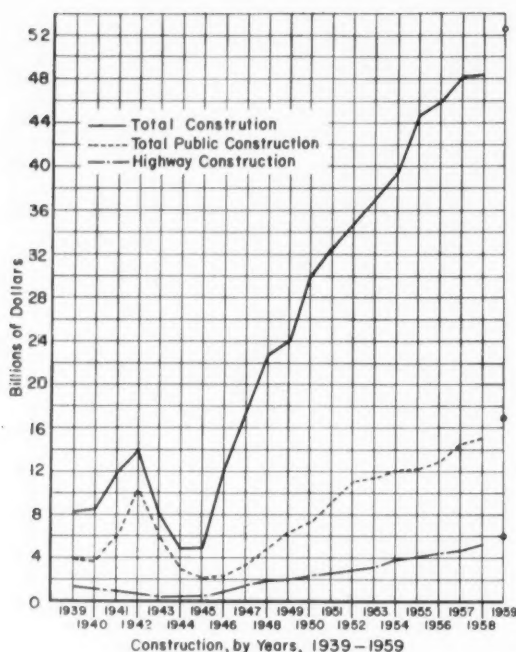
Let us turn now to an examination of the factors that will influence the future trend of business. I have found it useful to divide these factors into three groups: expanding, neutral, and negative.

### Expanding Forces

Government spending will continue to rise. Because of larger expenditures for defense and other programs, it is expected that Federal spending will



Changes in construction costs and wholesale prices. Note divergence of two curves in period 1951-1955.



Total construction, total public construction, and total highway construction during period since 1939.

contribute an additional \$3.5 billion to gross national product in the next year. These expenditures will be reflected in more orders to industry and are acting already to bolster order backlogs.

State and local government spending for education, highways, hospitals, and similar public works has been rising at an annual rate of about \$2½ billion in recent years. It is expected that this rate of increase will continue over the next year. In the recent election taxpayers again approved many new bond issues. Bond issues totaling \$2.5 billion were submitted to voters in 21 states; about half of the projects were rejected. However, the approved list was close to 80 percent of dollar volume. Thus, Federal, state, and local spending combined should add approximately \$6.0 billion to total national economic activity.

#### Disposable Income

Consumers' disposable income is at a new record level and further increases are probable. During the recession, labor income fell about \$9.0 billion at annual rates because the reduction in hours and in the number employed more than offset the effects of moderate increases in average hourly earnings. (For all manufacturing industries the increase was 6 cents an hour.) Labor income has recovered most of this loss. As a result of further increases in wage rates, longer work weeks, and greater em-

ployment, labor income should increase to new record levels in 1959. This rise in consumer income will be offset in part by a reduction in unemployment insurance payments. The U.S. Department of Agriculture has recently estimated that largely as a result of the anticipated decline in some agricultural prices, realized net farm income will fall "some 5 to 10 percent." Only minor net changes seem probable in other types of consumer income including dividends, interest, and rental income. On balance, a further rise in consumer incomes seems assured. The rise in consumer incomes will increase total consumer spending to new record levels.

#### Automobile Production

The nation's automobile industry should share in the greater volume of consumer spending. For 1958, auto output was estimated at 4.3 million units or the lowest level in the past decade—except for 1952 when output also fell to that level as a result of the Korean War controls. The 1958 decline in auto sales reflected the uncertainty and unemployment which characterize a recession. The fact that the wartime deferred demand had been fully supplied meant that the postponement of buying, which is a typical recession phenomenon, played an important role in the 1958 decline in auto sales. The business recovery means more jobs and better jobs. This will lead to an expanding demand for automobiles. In 1958, auto purchases accounted for only about 3 percent of consumer income as compared with a normal rate of above 4 percent. With recovery, consumers will spend more freely and automobile sales should once again rise above the 5 million mark.

Inventory liquidation should shift to inventory accumulation by the spring of 1959, if not earlier. This shift can give the economy a stimulus of \$6 billion or more. It should have its greatest impact early in the year. It is a powerful expanding force.

#### The Building Industry

Contract awards, which portend future spending for building, have risen to record levels. While there are still some lagging areas, such as manufacturing plants, these are more than offset by the sharp expansion in contracts for highways and other heavy engineering projects, schools, and electric power plant construction.

The U.S. Departments of Commerce and Labor have projected a total volume of \$52.3 billion for 1959. This would be about 2 percent above the \$51.5 billion rate in October and 7 percent above the average of \$49.0 billion in 1958. Most of the increase is expected to take place in public building, which would rise from the October 1958 level of \$16.1 billion to about \$17.1 billion in 1959. A

further increase is anticipated in school construction while the volume of office building construction is expected to decline about 4 percent.

### Highways

A very significant part of the expansion will be accounted for by the highway program. Total expenditures for highways have risen as follows in recent years:

	Millions of Dollars
1956	4655
1957	5215
1958 (est.)	5300

It is anticipated that there will be a further increase in activity in connection with the 41,000 mile Federal interstate highway system. On the other hand, a large decline in toll road construction and in state financed highway construction has taken place. Total expenditures for highways are estimated at \$6.0 billion for 1959—a new high. However, it must be recognized that these estimates are in dollars. In physical units, the increase in the past has been smaller because price inflation has affected significantly the dollar total. In 1959 again, the expansion in units will be less than the expansion in dollars.

### Neutral Forces

Surveys of plant and equipment spending suggest that the decline in this area has ended. For the fourth quarter, government surveys projected a slight rise above the low point reached in the third quarter. A small rise in this spending is now being projected for 1959. The McGraw-Hill survey indicated a rise of only 1 percent in 1959. This area may shift to the expansion group as 1959 progresses, but I do not anticipate a new boom such as we had in 1955-57 in this type of business spending.

There are many reasons for this conclusion.

¶ Many industries have ample capacity. One legacy of the 1955-57 boom was an overexpanded plant. The steel industry, for example, has a capacity to produce about 145 million tons; production has never exceeded 117 million tons in the past. The aluminum industry also finds itself with surplus capacity. It has been estimated that manufacturing capacity has been expanded about 80 percent since 1947, capacity for basic raw materials by about 55 percent. In time we will grow up to this capacity in most industries. In the meantime, there will be generally less eagerness to finance large increases in new capacity.

¶ The 1955-57 boom was helped by the availability of accelerated amortization certificates. However, little support can be anticipated from this source unless there is another war crisis.

¶ Profits have declined sharply below the 1957

TABLE 1

	Corporate Profits	Dividends Paid	Undistributed Profits
	(billions of dollars)		
1957 - 1st quarter	23.1	12.5	10.6
2nd quarter	21.8	12.6	9.2
3rd quarter	22.1	12.7	9.4
4th quarter	20.0	12.0	8.0
1958 - 1st quarter	15.5	12.5	3.0
2nd quarter	15.7	12.4	3.3
3rd quarter (est)	18.5	12.5	6.0

levels. From an annual rate of \$23.1 billion early in 1957, the total fell to about \$16.2 billion in the first half of 1958. While profits increased sharply in the second half of the year, at this writing they are still far below their previous peaks. One result is less incentive to invest funds in new plant and equipment. A second result has been a reduction in the volume of funds available to finance the expansion. With dividends well maintained, the entire brunt of the decline in profits fell on undistributed profits as is shown in Table 1.

### Depreciation Charges

Compared against the declines in the funds available from corporate profits, there has been a rise in depreciation charges. Thus, in the year ending June 30, 1958, total depreciation was estimated at about \$20.6 billion or \$2.0 billion higher than the previous year. This rise in depreciation charges reflects the combination of a larger investment and liberalized depreciation provisions of the tax law. A steadily increasing volume of funds has become available from this source. (The total was \$6.2 billion in 1948 and \$11.0 billion during the year that ended June 30, 1953.)

¶ Higher interest rates act as a restraining force in some instances. Long-term interest rates fell sharply during the early part of 1958; yields on Aaa bonds fell from 4.12 percent in the fall of 1957 to 3.57 percent in June. By October, the yields had returned to the levels of 1957. The yields on lower-rated bonds also showed a generally similar pattern. As the costs of financing rise, some marginal projects are abandoned.

¶ The backlog of plant and equipment spending has shown no expansion. The National Industrial Conference Board survey of capital appropriations has recorded no upturn. Since there is a considerable time lag between appropriations and actual spending, these data lend no encouragement to a hope that a new boom will soon be underway.

Because of these factors, major emphasis will be given to modernization of existing facilities rather

than to expansion in capacity. According to a McGraw-Hill study, it would cost about \$95.0 billion to replace today's obsolete equipment. As recovery moves ahead management will become increasingly interested in moving ahead with building programs.

#### Negative Factors

Residential housing has expanded sharply since early in 1958. At annual rates, the total number of housing starts rose from under 920,000 in February-March to 1,260,000 in October. This was the highest level in three years. The combination of government loans, easier credit terms, and greater availability of credit contributed to this sharp rise in the number of housing starts. However, the impact of these forces is now behind us. Interest rates have begun to rise again and the billion dollars available to buy mortgages has been fully committed by the Federal National Mortgage Assn. It is still uncertain whether the new Congress will make additional funds available. The interest rate on government-incurred home mortgages, in many instances, is not as attractive as the rate on other types of lending. Moreover, the government's need for funds to finance the budget deficit will act to reduce the supply of funds available for mortgages. It is not improbable that when the full impact of these factors is felt, housing starts will decline below the current level. The Federal government's estimate for 1959 is about 1.2 million starts. The F. W. Dodge estimate is for a little lower level of housing starts. Hence, housing will become one of the negative factors.

The major negative factor in the economic picture today is the tightening of money and credit with the accompanying rise in interest rates. In August, the Federal Reserve Board signaled a reversal of its very easy money policy by increasing stock margin requirements and by approving a rise in the discount rate. In addition, the Federal Reserve has acted to reduce excess reserves from \$600 million to about \$100 million. Recently, stock margin requirements were raised to 90 percent, and the discount rate was increased — from 2 to 2½ percent. The net effect of these actions combined with the renewed fear of inflation has been a rise in interest rates. Long-term interest rates have increased to the levels of the fall of 1957, when the Federal Reserve initiated its anti-recession easy money policy. This rise in interest rates has led to some reconsideration of new financing. It could cut off some demand for new housing and could curb some potential buyers of consumers durable goods.

#### The Inflation Picture

Construction costs have risen fairly steadily since 1939. The Department of Commerce index of con-

struction costs was 51 (1947-49=100) in 1939, 67 in 1945, 107 in 1950, and 137 in September 1957. By September 1958, the index had risen to 139. Higher prices for materials and higher labor costs have added significantly to construction costs. For example, in the past year average hourly earnings for construction workers rose from \$2.90 to \$3.00 — and further increases are assured in 1959.

Today there is a widespread fear of price inflation. However, I am convinced that the fears of inflation are being considerably exaggerated insofar as they apply to 1959. The reasons for this conclusion are:

¶ Up to this point, sensitive prices which are most responsive to inflationary pressures have recorded only minor changes. The same is true for wholesale prices.

¶ Our money supply has been increasing at less than the 3 percent long-term rate of gain. The Federal Reserve Board probably will act to contain any new major gain in money supply.

¶ The Federal budgetary deficit is a significant force for inflation. But economic recovery will mean higher tax revenues and, in turn, a smaller deficit. Similarly, recovery will reduce payments for unemployment insurance and increase the taxes collected. Thus, the cash deficit will fall faster than the deficit in the administrative budget, and inflationary pressures from this source will be reduced accordingly.

¶ Record farm crops will act as a barrier to inflationary price rises for foods. The U.S. Department of Agriculture has predicted a decline in these prices. This is a very important factor in the consumer price index.

¶ Wage inflation should be smaller than in the past three years because labor costs will rise more slowly and output per manhour will increase more rapidly — at least during the first year of recovery.

¶ We no longer have large backlogs of deferred demand to create urgent pressures on prices.

Because of these factors, I anticipate that the current inflationary fever will subside and that price indexes will not record a major advance in the next year. As in past years, however, construction costs probably will continue to rise.

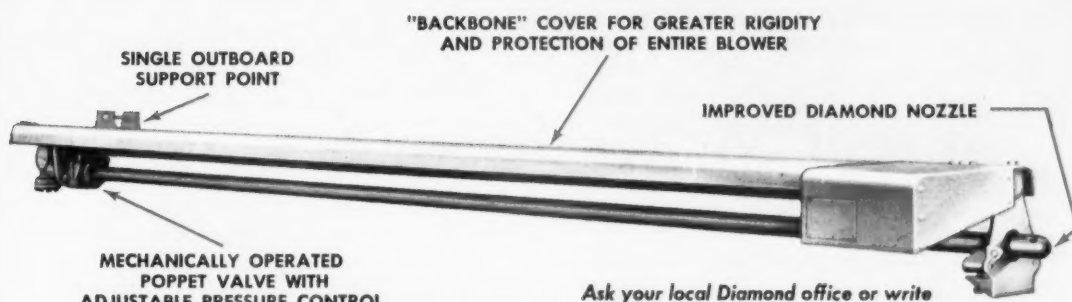
#### The Outlook

Business recovery will continue in 1959. The national level of output should reach new high levels later in the year. In dollar terms, the new highs probably have been achieved now — in December and January. The volume of construction continues to point upward. It is probable that in 1959 the total will reach new record levels. However, factory construction should lag behind previous peaks while public construction, including highways and schools, will be at new record levels. ▲▲

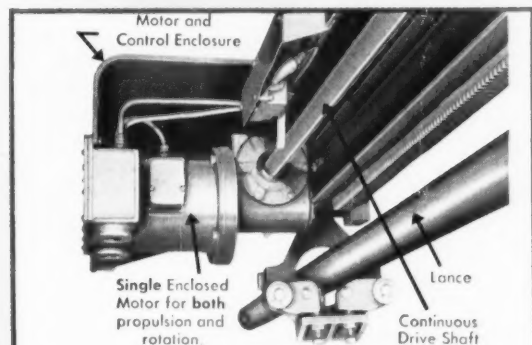
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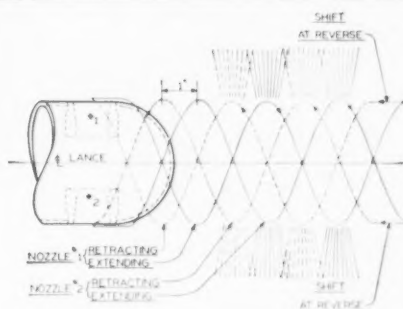


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*Oil refineries use treated sewage plant effluent for cooling, boiler feed, and general process operations.*

## Fresh Water From Sewage

DAVID LEVY and VINCENT J. CALISE  
Fluor Corporation and Graver Water Conditioning Co.

**C<sub>E</sub> exclusive** ENGINEERS in this country still are reluctant to accept treated sewage plant effluent as a source of water for industrial and municipal purposes in spite of water shortages in many key industrial areas. Even in areas where the quality of effluent has been steadily improved as a result of modernization of existing sewage treatment plants and the addition of secondary plants, this potentially large reservoir of usable water has remained virtually untouched. This situation is in contrast to European practice where reuse of treated sewage plant effluent is not uncommon.

To a large degree, the reason for this neglect is the lack of awareness that this water source is available and can be purified and treated for many industrial uses at low cost. The difficulty of negotiating contracts satisfactory to both municipalities and industrial users for the adequate supply of sewage plant effluent also has been a major factor.

Actually sewage plant effluent reuse is widespread. Every city that draws water from a river

into which some other city has discharged its waste is making use of effluent. While it may be true that streams often purify themselves, sometimes the heavy discharges of sanitary and industrial wastes change a stream into little more than an open sewer. This sounds distasteful, but for many applications, effluent from a properly operated secondary treatment plant may be superior to available surface supplies in the same locale.

Water — whether waste, well, or surface supply — should be considered simply as a carrier capable of continual reuse. A publication of the California Water Pollution Control Board states: "There appears to be no physical reason for treating waste water as being fundamentally different from any other water source. The uses to which it can be put are the same, and the precautions taken before using it are the same."

### Present Applications

The Bethlehem Steel Company at Sparrows Point, Maryland has used the treated effluent from two

sewage disposal plants in Baltimore for process and cooling since 1941. The city guarantees 50 mgd of this effluent of a quality suitable for supplementary clarification at the mill.

At the Fontana, California plant of Kaiser Steel Company both sanitary and industrial waste water is reclaimed and reused about 40 times. For each ton of steel produced, 50,000 gallons of water are recirculated with a makeup of 1400 gallons. Sanitary wastes are treated in a biofiltration process and transferred to the industrial water system. Acid wastes from the pechling process are neutralized with lime, precipitating calcium sulfate which is concentrated by vacuum filters. The water then is treated by biofiltration and returned to the main system. With a total water demand of about 130 mgd, only 3 mgd of makeup is required.

Sewage plant effluent also is used as a source of cooling water, boiler feedwater, and general purpose plant water in five southwestern and mid-western oil refineries.

The Golden Gates Park reclamation plant in San Francisco, California takes about 1 mgd of water from sewers for irrigation and for streams and lakes in the park. Although a separate drinking water system is provided, officials claim "drinking water standards are maintained in the reclaimed water."

One municipal incinerator uses sewage effluent for cooling purposes, and sewage plant effluent also



*Equipment for on-site treatment of sewage plant effluent includes high-rate solids-contact units.*

is used for replenishment of groundwater in California. In the Los Angeles area, sewage plant effluent from the Hyperion sewage plant is being considered for recharging of underground aquifers to prevent seawater encroachment and to provide an industrial water source for local industry. In California, at least, there appears to be no official restraint in acceptance of waste water reuse.

### Three Conditions

Three conditions are necessary for practical reuse of sewage plant effluent by an industrial plant: "The municipal sewage treatment plant must be large enough to supply the quantity of effluent required by the industrial plant.

"The municipal plant must be able to deliver a reasonably consistent quality of water suitable for reuse by the particular industry.

"The cost of processing the sewage plant effluent, including transportation to the point of use, must be competitive with the cost of alternate supplies.

### Cost Estimates

Developing cost estimates for reclaimed water requires careful study and evaluation. Where the effluent is drawn directly from the municipal treatment plant, communities generally require a contract establishing a service charge based on quantities made available, just as in potable water service. A contract is desirable for the industrial user also because it secures cooperation in eliminating or minimizing objectionable industrial waste discharges which may affect the operation of the sewage treatment plant and the quality of its effluent.

There are many complex constituents present in sewage plant effluent that may require removal. These include organic matter, synthetic detergents,



*Organic substances must be removed before effluent is treated in hot process hot zeolite softeners.*

and nitrogenous materials. The most valuable tool for planning facilities to produce an acceptable quality of water in the using plant is a well organized series of jar tests, best run with samples of effluent taken directly from the municipal plant outfall. Techniques involved in these tests are not new, but substantial skill and experience still are required not only in planning and running the tests but in translating results to plant-scale equipment. In running a test series, it is important to plan conditions so that only one factor is studied at a time. Frequently pilot plant testing with prototype equipment is needed.

#### Careful Design is Necessary

The consulting engineer must specify the equipment and chemical feeds for the worst or maximum foreseeable conditions of chemical and flow demand rather than for average or optimum situations. Extreme flexibility in design of treatment equipment as well as in number, type, and control of chemical feeders and in the chemicals used is required to assure dependable operation. The degree and completeness of preliminary laboratory and pilot plant work performed depends upon the anticipated use and quality required of the reclaimed water.

Modern activated sludge sewage treatment plants can produce an effluent that can be used without further processing in some once-through cooling water systems. However, in many applications for recirculating cooling systems and for boiler feed-water makeup, additional treatment of effluent is required to reduce color, B.O.D., suspended solids, phosphates, or synthetic detergents. For this pur-

pose, established methods of water treatment involving clarification and softening in conventional or high-rate solids-contact equipment, hot process-hot zeolite softening, demineralizing, and pH correction are available.

#### Composition and Variation

Effluent for reuse normally will be supplied by sewage plants utilizing these methods of treatment:

† Simple primary treatment and separation

‡ Primary treatment plus secondary aerobic oxidation obtained with trickling filters and activated sludge units

Table 1 shows typical suspended solids and B.O.D. analyses of effluent from a number of plants handling both primarily domestic sewage and influents containing a high percentage of industrial wastes. It will be noted that in plants having only simple primary treatment and separation, the suspended solids and B.O.D. content of the effluent is relatively high. Both constituents are reduced substantially, however, in effluents from plants combining primary treatment with secondary biochemical oxidation.

Compared to local surface or well water supplies, most sewage plant effluents have higher B.O.D. and nitrogenous content, higher color, and greater quantities of total dissolved solids. Effluents also contain phosphates and detergents.

#### Effect of B.O.D.

The B.O.D. content of sewage plant effluent, and its equivalent organic matter concentration, can be a troublesome factor in reuse operations. Most cool-

TABLE 1 — TYPICAL ANALYSES OF SEWAGE PLANT EFFLUENT

Type of Sewage Plant Effluent	Suspended Solids ppm	B.O.D. ppm	Suspended Solids ppm	B.O.D. ppm	Suspended Solids ppm	B.O.D. ppm
<b>Primary Treatment Only</b>						
	<b>Plant A</b>		<b>Plant B</b>		<b>Plant C</b>	
Primarily Domestic Waste	72	82	70	60	80	105
High % Industrial Waste	108	78	115	74	93	124
<b>Primary Treatment Plus Trickling Filters</b>						
	<b>Plant D</b>		<b>Plant E</b>		<b>Plant F</b>	
Primarily Domestic Waste	34	33	28	18	36	27
High % Industrial Waste	62	54	45	79	42	36
<b>Primary Treatment Plus Activated Sludge Units</b>						
	<b>Plant G</b>		<b>Plant H</b>		<b>Plant I</b>	
Primarily Domestic Waste	13	13	23	40	10	3
High % Industrial Waste	12	5	40	24	12	10

ing water requires the absence of organic materials, which can lead to pitting and localized attack on metal surfaces. Also, organic matter in a cooling water system exposes the plant to expensive outages for the maintenance and cleaning required to remove accumulations of slimes and algae. Organic matter can be troublesome in boiler operation as well.

Where ion exchange equipment such as hot or cold zeolite softeners, demineralizers, or hydrogen-sodium blend systems are to be used for post treatment of sewage plant effluent, adequate pretreatment and removal of potentially fouling organic constituents is mandatory. Coagulation, chlorination, and prefiltration may be required. But regardless of the method, the consultant must see to it that his design for any specific application provides reduction of B.O.D. to a manageable concentration.

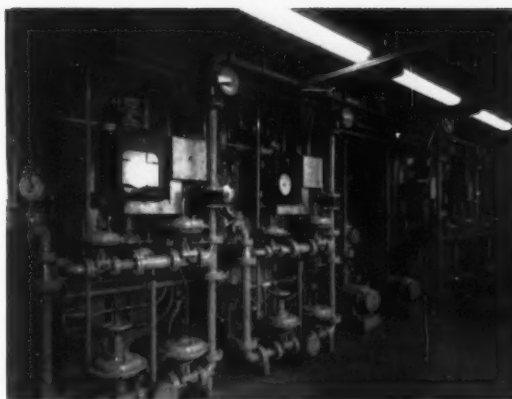
### Effect of Color

To avoid the formation of slimes and organic coatings and to prevent substantial foaming in boilers, it is necessary to remove organic coloring compounds together with other suspended matter. Maximum color reduction with alum generally is achieved in the pH range of from 5.6 to 6.5. In highly colored waters such narrow limits apply because organic impurities and detergents which cause this coloration tend to stabilize the small floc particles that start to form earlier in the treatment and prevent them from growing to sufficient size.

If prechlorination is used, good results frequently are obtained at pH values as high as 7.5. Chlorine partially destroys coloring substances, reducing the stabilizing action, and produces a lower residual color for a given coagulant dosage. When iron salts are used as a coagulant, flocs tend to settle faster than with alum, but color removal is usually less. By adding chlorine to this treatment, adequate color reduction frequently can be obtained. The order of addition of the alkali, coagulant, and coagulant aid is important and should be investigated as part of the preliminary tests.

### Effects of Other Impurities

Nitrogenous material of the aluminoid type usually is reduced substantially by simple coagulation. Soluble nitrite and nitrate salts, on the other hand, are unaffected by the usual coagulant chemicals and treatment. These dissolved nitrogen compounds are not often troublesome in cooling water applications and in some boiler feedwater uses. However, when they occur in the reduced form, as ammonia or the ammonium ion, they concentrate in the boiler salines and are distilled off at a high pH as ammonia. This redissolves in condensed steam and attacks copper or copper alloys. Where this may



*Demineralizers, like all ion exchange equipment, demand removal of potentially fouling organics.*

occur, carbon steel or steel alloy pipes and fittings should be specified.

In modern cooling water treatment processes (such as low pH, high metaphosphate, or combination phosphate-chromate treatments), the presence of somewhat higher than usual quantities of dissolved solids in recirculating cooling water systems is frequently not serious. However, total dissolved solids content is extremely important where treated effluent is to be used for high pressure boilers. The internal treatment must be evaluated carefully in terms of the effects on blowdown, potential scale formation, and carryover conditions. Also, in effluents from plants where sanitary sewage percentage is high, and in high hardness areas where domestic zeolite softeners are used, high chlorides are likely to be found.

Apart from possible interference in the normal operation of sewage treatment equipment, synthetic detergents in significant concentrations may affect both cooling water and feedwater preparation. Where difficulties have occurred, however, the concentration of detergents in the treated water has been abnormally high. Both detergents and phosphates can act to inhibit chemical coagulation or softening reactions, and full testing is required to determine proper preventive measures.

### Design of Large-Scale Installations

The experiences of a large petrochemical manufacturer in the southwest in building a plant close to a natural gas field demonstrates the advantages of reusing sewage plant effluent. This plant site is in an area that has been hampered by a serious water shortage. Yet makeup water was required for a recirculating type cooling water system and for the feedwater system serving the plant's low pressure boilers. (Condensate from these low pressure boilers

**TABLE 2—RESULTS USING WELL WATER**

<b>Methods of Treatment</b>			
<i>For cooling: Cold zeolite softening &amp; acid feed</i>			
<i>For boiler feed: Hot process - hot zeolite</i>			
<b>Constituents as CaCO<sub>3</sub>*</b>	<b>Raw Well Water</b>	<b>Effluent for Cooling</b>	<b>Effluent for Boiler Feed</b>
Calcium	202	2-5	1-2
Magnesium	96		
Sodium	55	348	205
Total Cations	353	353	207
Bicarbonate	166	5-10	—
Carbonate	—	—	20
Sulfate	88	244	88
Chloride	99	99	99
Total Anions	353	353	207
Total Hardness	298	2-5	1-2
MO Alkalinity	166	5-10	20
pH	7.45	6.8	10.2
Silica as SiO <sub>2</sub>	17	17	2.3

\*Constituents are expressed as CaCO<sub>3</sub> except as noted

also feeds the plant's high pressure boilers.) Flow requirements could be as high as 4.33 mgd.

A study of the local water resources showed that the city's well water supply system could meet only the immediate short-range water requirements of the manufacturer. Future plant expansion could not be guaranteed on a basis of the current available reserves. (See water analysis in Table 2.)

Attention then was turned to the city's municipal sewage treatment plant. It was determined that the addition of a secondary activated sludge process

was economically feasible. Estimates by the city showed that amortization on secondary plant equipment, prorated for the manufacturer's share of total sewage plant flow, could be accomplished by charging 6¢ per million gallons for this effluent.

#### Cooling Towers, Low Pressure Boilers

Studies were conducted to establish the optimum process and chemical treatment that would produce the required makeup water quality for the cooling tower and the low pressure boilers. A comparison of the results indicated that the lowest installed equipment costs for the treatment of city well water and of secondary sewage plant effluent (assuming softening and clarification is common to both) and the operating costs per million gallons would be as follows:

##### City Well Water

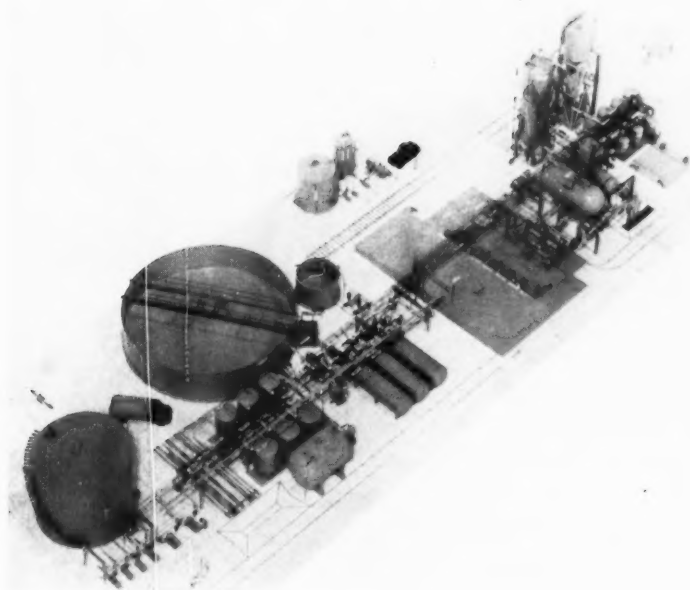
Sodium zeolite softeners for makeup to cooling tower	\$100,000
Hot process-hot zeolite (for boilers)	\$250,000
Total	\$350,000
Operating cost — zeolites	15¢
Operating cost — hot process-hot zeolite	20¢
Cost of well water	28¢

##### Treated Sewage Plant Effluent

Sodium-hydrogen blend system	\$200,000
Hot process-hot zeolite	\$200,000
Total	\$400,000
Operating cost — hydrogen-sodium blend	34¢
Operating cost — hot process-hot zeolite	20¢
Cost of sewage plant effluent	6¢

**TABLE 3 — EXPECTED RESULTS FROM TREATMENT SYSTEM SHOWN IN THE FLOW DIAGRAM**

	(1) Incoming Sewage Plant Effluent	(2) Treated Process Water From Clarifier	(3) To Cooling Towers From Blend System	(4) After Hot Process Unit Treatment	(5) After Hot Zeolite Unit Treatment	(6) Final Makeup Water To Boilers
Calcium	187	125	1-3	176	1-3	0-2
Magnesium	216	25	1-2	30	1-2	0-2
Sodium	650	931	636	650	851	645
Total Cations	1053	1081	641	856	856	649
Bicarbonate	396	—	10	—	10	22
Carbonate	—	350	—	130	—	0
Hydroxide	—	100	—	100	—	0
Sulfate	178	238	238	238	458	238
Chloride	383	383	383	383	383	383
Phosphate, Total	96	10	10	5	5	6
Total Anions	1053	1081	641	856	856	649
Total Hardness	403	150	5	206	5	0-4
MO Alkalinity	396	450	10	230	10	22
2P - MO	—	100	—	100	—	—
Silica as SiO <sub>2</sub>	44.5	44	40	5	5	15

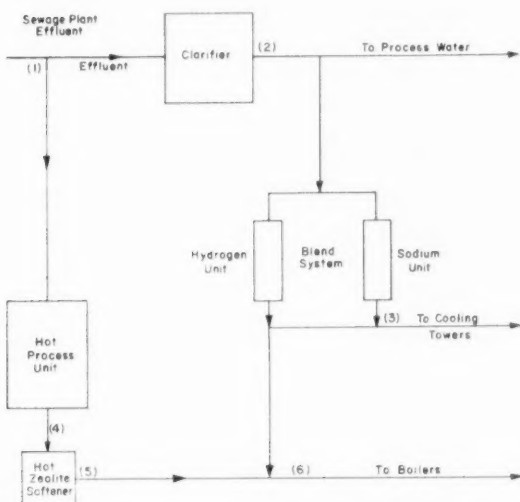


*Model of sewage effluent treatment plant shows the compact equipment arrangement that is possible with attention to design details.*

In the final analysis, the existing and future scarcity of fresh or well water from the city was extremely influential in deciding in favor of sewage plant effluent treatment. Details of the system are shown in the flow diagram, which includes numbers to facilitate cross referencing with the analyses listed in Table 3.

#### Typical System

Approximately 2900 gpm of the water from the secondary sewage plant (1) enter the system. Of this



*Flow diagram shows how sewage plant effluent is treated for process work, cooling, and boiler feed.*

total, 2600 gpm will be clarified and softened in a high-rate upflow solids-contact unit employing lime, soda ash, and alum – plus chlorine and poly-electrolyte if necessary (2). Some of this clarified stream will be used for process water. For the cooling tower, approximately 1600 gpm of this clarified stream will flow through a sodium-hydrogen zeolite blend system where proper selection of a blending ratio will produce makeup for the recirculating system having zero hardness, lowest alkalinity, and lowest total dissolved solids (3).

The remaining 300 gpm of sewage plant effluent flows directly to a hot process – (4) hot sodium zeolite (5) plant where it will be treated with lime and aluminate – plus soda ash if needed. A slip stream of 100 gpm of hydrogen zeolite water from the sodium-hydrogen blend system then will be blended with the 300 gpm from the hot process-hot sodium zeolite plant. The blended 400 gpm stream of hydrogen-sodium zeolite water ultimately flows to a deaerating heater and to the low pressure boilers (6).

#### Wider Use Indicated

In view of the growing water shortage in many areas where industrial plants are located, and in view of the advanced water treatment technology now available, a much wider use of sewage plant effluent is indicated. This frequently disregarded water supply can be an excellent source for many plant applications, and often can prove to be the least expensive solution. Many plants already are using sewage effluent to good advantage. ▲▲



Well lighted and air conditioned engineering department is arranged with department chiefs' desks at right; library in center.

# Organization Problems in a Consulting Firm



DAVID L. NARVER, JR.  
Vice President, Engineering  
Holmes & Narver, Inc.

*David L. Narver, Jr. attended Stanford University, receiving an AB degree in 1941, AM degree in 1943, and his engineering degree in 1948. During his professional career he has served in the U.S. Navy on overseas base construction as a Lt., C.E.C. At Holmes & Narver, he has served in various capacities on numerous important engineering assignments. He is a registered civil engineer and structural engineer in California, and a member of the Consulting Engineers Association of California, ASCE, and ACI. Currently Narver is a director of CEAC and first chairman of the ASCE National Committee on Nuclear Structures and Materials. He also is a past vice president of the Los Angeles section of ASCE.*

AS SOON AS AN ENGINEER, starting in private practice, adds a draftsman or a stenographer, he must face the fact that he now heads an organization. As his firm grows, the problems of organization grow too—not arithmetically, but apparently in a sort of geometric progression. Also, no matter how large an engineering organization becomes there is still the need to keep in close contact with the client and continue to render *personal* services. But it takes careful planning and good organization to retain the professional relationship between the client and consulting engineer when a firm has grown to "big business" proportions.

At Holmes & Narver we have known the problems of the small (in the '30s); the middle-size (the '40s); and during the past few years, the large engineering organization. Last year, for example, our firm was involved in the engineering or engineering and construction of projects valued at about \$200 million. Since our founding in 1933, we also have changed from a straight engineering firm to engineering and construction in certain specialized fields. However, we deal with con-

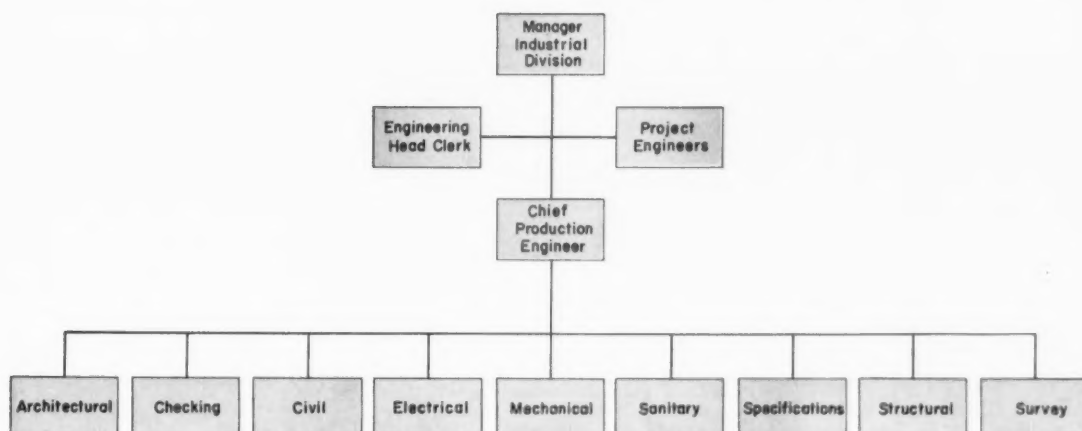
struction only on projects on which we do the engineering. It is against our policy to bid for construction on projects designed by other engineers. We are still, basically, an engineering firm, not a construction firm.

## Division of Responsibility

In our moving from the small to the large size firm, we have learned much about the importance of wise division of responsibility and careful organization and administration of the staff. The proper management of an organization of our current size requires, we have found, a separation into divisions, all working together when required, but each with a reasonable degree of autonomy.

At Holmes & Narver we have set up five divisions: industrial, nuclear, missiles, petro-chemical, and construction.

¶ The industrial division does complete plant planning and facilities design, engineering, and construction supervision. The division employs specialists in civil, structural, mechanical, electrical, and sanitary engineering, surveying, and architectural design.



*Holmes & Narver industrial division organization chart showing lines of authority and engineering departments.*

¶ The nuclear division offers consultation on designing safe facilities, prepares hazards summary reports, outlines and discusses requirements for obtaining licenses to build and operate nuclear facilities, and prepares required technical reports.

¶ The missiles division handles investigations and studies covering various aspects of operational bases and support facilities, as well as design, for missiles, some of which have been the Atlas, Thor, Titan, and Nike missiles.

¶ The petro-chemical division, staffed by men experienced in the fields of refinery construction and operation and chemical processing, handles the design of petroleum and chemical processing facilities and plants.

¶ The construction division complements the four engineering divisions, providing for the client complete turn-key projects where this is desirable.

#### **Staff Organization**

All of the engineering work of the various divisions is coordinated under an engineering vice president, with managers of each division and a chief design engineer reporting directly to him. Organization of our industrial division is shown on the chart, and its work closely corresponds to the type of engineering done by many consulting firms throughout the country. In itself it serves as an example of what we feel is good organization of a firm offering professional services.

Engineering work in our industrial division is assigned to either a project organization or to a base force. The base force is a training ground for key personnel who will become the nucleus of project groups. Made up of the cadre of the division, it generally handles jobs requiring less than a year's work. If the work involves a continuing large contract of over a year's duration, a separate

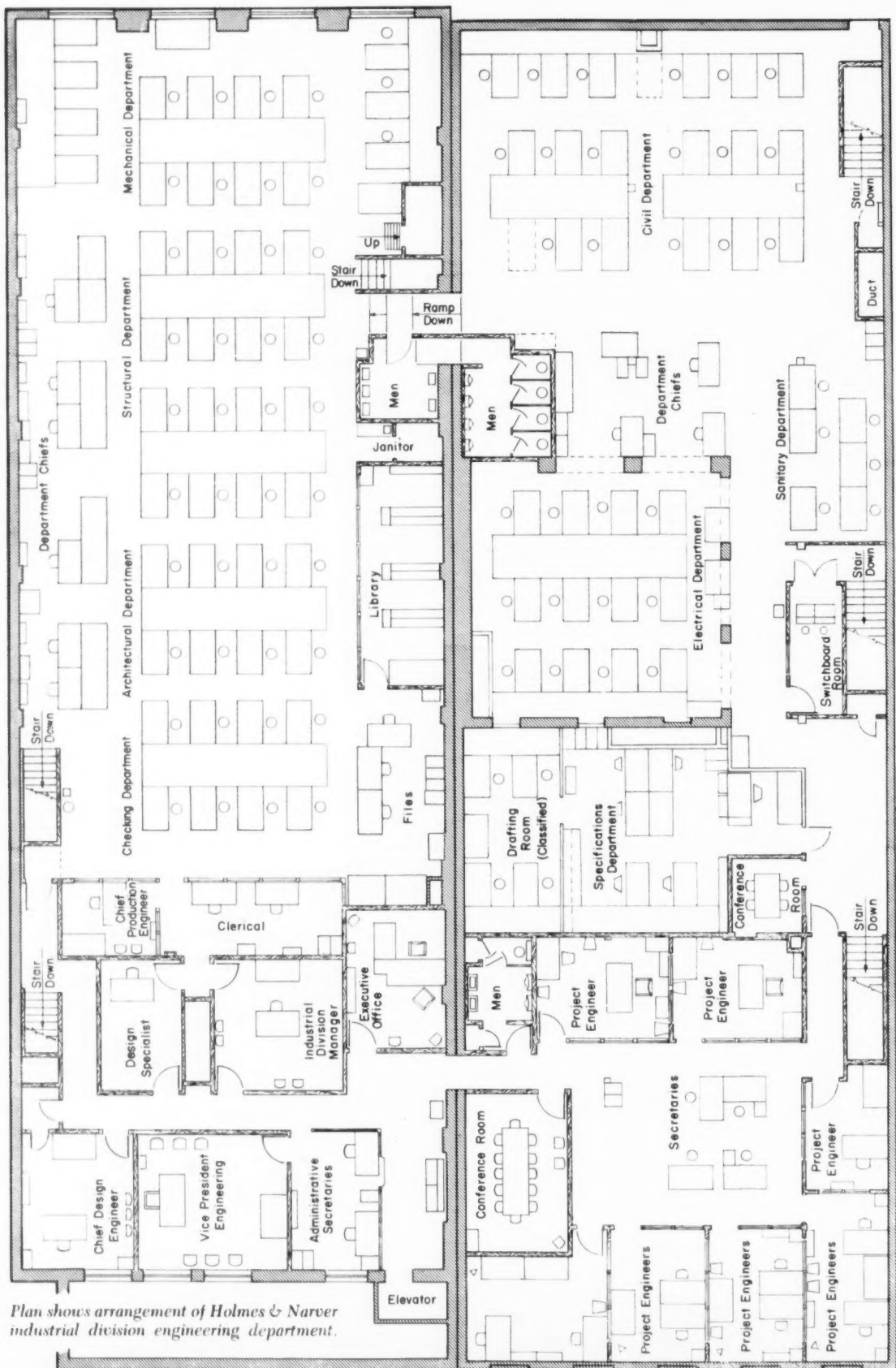
project group is organized, with the base force or another division helping to absorb peak loads. Each project group or base force has two primary engineer groups: a production force and a project engineering force.

#### **Production Force**

The production force has lead men (section heads) who are the equivalent of chief structural engineers, chief mechanical engineers, or chief electrical engineers in other companies. The section head and his group do the actual detailed design and drafting. A section head can efficiently supervise approximately 15 men; many more than that means he spends too much time doing nontechnical paper work and wastes his own technical knowledge. With only 15 to supervise, the section head has time to help educate the younger engineers. Representing the various design specialties, these section heads report to a chief production engineer, who is held responsible for maintaining schedules and quality of work. In turn, the chief production engineer reports to a chief engineer or engineering manager.

#### **Project Force**

Project engineers also report to the chief engineer or engineering manager. Project engineers are top engineers, generally specializing in one field but with a basic knowledge of other fields. The project engineers represent the client in the office, therefore they must have the ability to meet clients, determine design criteria, and decide on a course of action. They do not, however, do detailed design or oversee the draftsmen; that is the responsibility of the chief production engineer and section heads. Each project engineer is, therefore, capable of handling projects for several clients. Several project



Plan shows arrangement of Holmes & Narver industrial division engineering department.

engineers may confer to find a solution for a client, but only one actually contacts the client.

For over-all company technical knowledge, a group of top specialists reports to the engineering vice president. Used much like outside consultants, the top specialists make sure that all engineering, regardless of division, meets the company's quality requirements. Headed by the chief design engineer, our top specialists earn management salaries without having management responsibilities.

### **Engineers Do Engineering**

To conserve engineering talent, nonengineers prepare nontechnical portions of specifications, reports, and proposals, and also serve as office managers, clerks, and accountants. Salesmen have had engineering training, but need not be graduate or registered engineers.

We think it is important to use a maximum number of engineers on full-time engineering work. We want them to be called upon for only a minimum of management activity. This method, depending on the office size, even can include the president as a productive technical part of the work.

Our personnel department is composed of nonengineers, so technical talent is relieved of the details of hiring. After screening by the personnel department, the prospective employee is referred to the chief engineer or engineering manager for final decision.

### **Group Motivation**

Motivation in the large engineering office is sometimes a problem because the draftsmen and designers seldom participate in the profits. To encourage enthusiastic participation we ask each section head to look at each job and estimate the number of man-hours it will take his group to complete its specialty. These man-hour estimates are reviewed by the chief engineer to be sure they are reasonable. If the estimates appear too high or low, the section head may have misunderstood the work, and a re-evaluation then becomes necessary. The man-hour total then becomes the goal of the entire section, including the lowest junior draftsman. Man-hours are an especially good yardstick since they do not involve wage rates. However, this does require the chief production engineer to check periodically to be sure higher paid men are not doing lesser work so the section head can save a few man-hours.

### **Engineering Offices**

Proper operation of an engineering firm requires not only wise organization of the personnel but also the establishment of a suitable environment. The office must be adequate and well planned. To

better handle the work of our five divisions, Holmes & Narver found it advantageous to purchase an adjacent older building in 1955 and to remodel it for engineering and executive offices. All interior wood posts and partitions were replaced with steel columns and beams to support the original wood joists. An open patio was roofed over and a new second floor constructed in the area. A new first floor was poured and leveled. Modernization included a new power and lighting system and a new heating, ventilating, and air conditioning system.

### **Air Conditioning and Lighting**

All of the executive offices and most engineering departments are air conditioned. Both unit heaters and ducted heating systems are used. Lighting facilities, with minor exceptions, are 8-ft fluorescent tubes, two or four tubes per fixture. Lighting intensities at desk height are about 70-75 foot-candles in the drafting rooms and 50 foot-candles in offices. Ceilings are acoustical punched fiber board, woven metal with fiber glass backing, or acoustic plaster.

The second-floor plan—15,000 square feet of the firm's 110,000 square feet—shows the industrial division engineering department, which has a capacity of 34 desks and 102 drafting tables. Desks of section heads and drafting tables are arranged on one floor for easy communication. Because the company believes in having engineers get together and talk over problems whenever necessary, there are also convenient conference rooms.

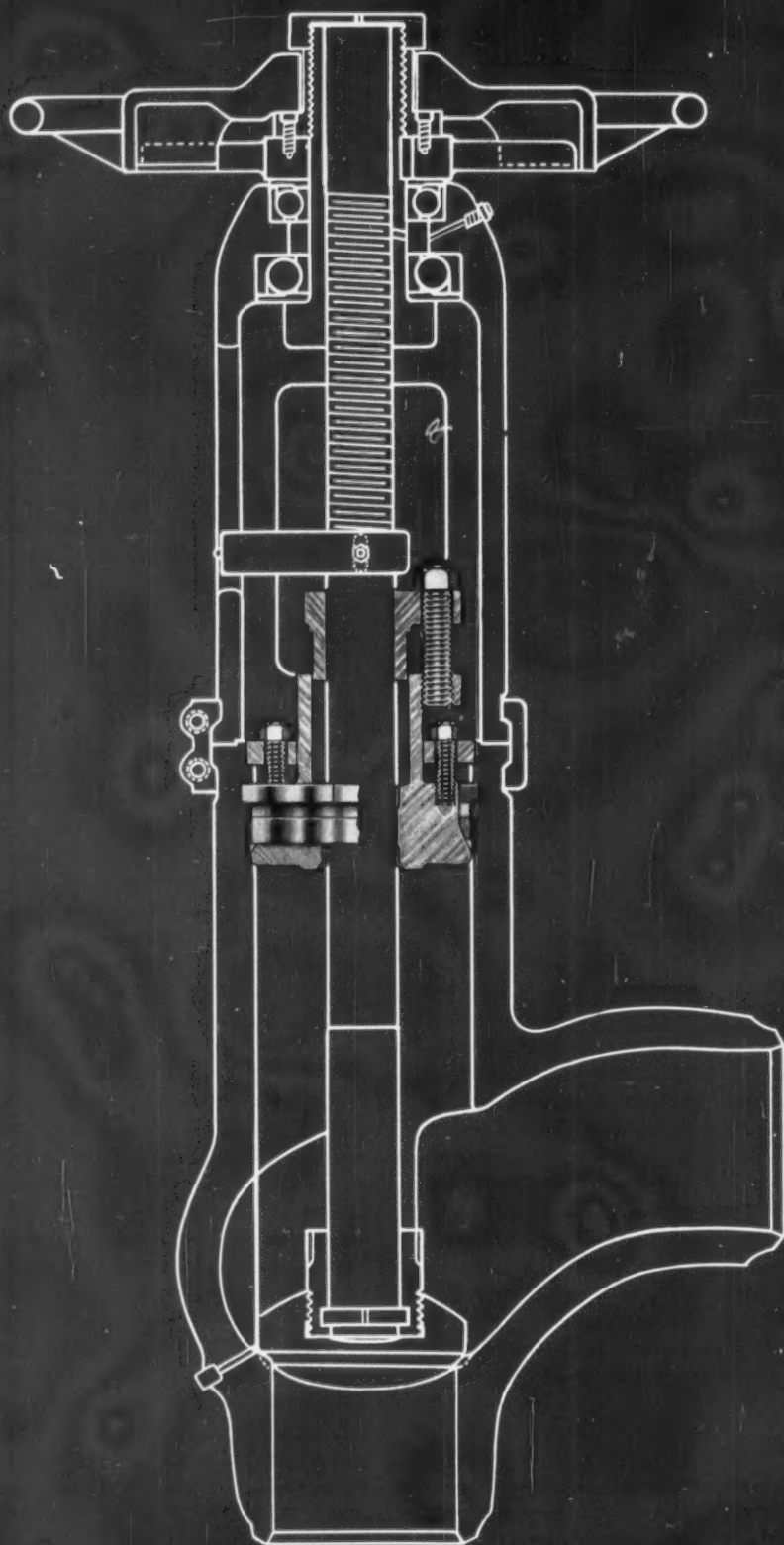
The central library contains approximately 500 technical books, 2000 catalogs, and the better technical society journals and professional magazines. A librarian maintains a card index on all material and a record of the items taken out.

### **Record Storage**

In an organization as large as Holmes & Narver, there is always the problem of drawing, report, and record storage. Many of these are useful as guides for new projects, but they soon occupy space needed for current jobs. To solve this problem, we established a record center at a nearby warehouse.

Reference requests average almost 1000 a month. Some are answered by reading information from the records over the phone; other requests require that the material be sent to the engineer.

By separating our firm into logical divisions, by emphasizing the assignment of engineers to a maximum of engineering work, and by providing adequate and well planned working space, we think we have gone a long way toward the successful operation of a large engineering firm that retains the professional character and personal client contact of smaller organizations. ▲▲



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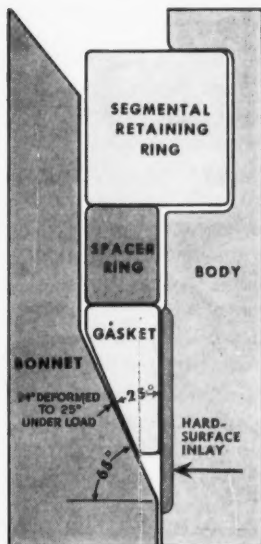
Advances in service temperatures (above 800 F) led to introduction, in 1945, of commercial steel valves with pressure-seal bonnet joint construction. These superseded bolted joint valves of earlier design.

The original 45° pressure-seal gasket, used by Edward and other manufacturers, was a significant improvement in minimizing leakage. But scientists in the Edward Research Laboratories refused to accept this as the best that could be done, set out to develop a better pressure seal joint.

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#### SPECIAL GASKET SEAL-COATING!

A special corrosion-resistant malleable coating (.001 inch thick) is applied to gasket, flows into minute irregularities, assures perfect seal.

#### IMPROVED BODY SEALING SURFACE!

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Body bore has been enlarged just above gasket area; this permits gasket to be easily lifted out, after segmental retaining ring and spacer are removed.

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# The Consultant In South Africa

... What to do with stranded lions

PETER HOLZ

Consulting Engineer Correspondent

**CE exclusive** JUST A FEW DAYS after the U. S. Consulting Engineers Council accepted FIDIC's invitation to join, the 44-member South African Association of Consulting Engineers also decided to apply formally for membership in the International Federation of Consulting Engineers. President of the South African Association, G. H. H. Legge, of the consulting firm of Messrs. F. E. Kanthack & Partners, told me that the South African body would in all probability be admitted to FIDIC since it, like the Consulting Engineers Council, had been invited to apply for membership at the annual FIDIC meeting in Oslo, Norway, last May. At that meeting Legge had been an observer for South Africa while Edward J. Wolff, immediate past president of the Consulting Engineers Council, represented the United States. Legge thinks that both South Africa and the U. S. will benefit from membership in this organization, particularly since membership fees are small while the benefits of international cooperation and exchange of ideas are great.

## Civil Engineers' Convention

The South African Institution of Civil Engineers has just held its second convention at the University of Witwatersrand, in Johannesburg, a convention well attended by South African consultants. Mr. B. Schoeman, the Minister of Transport opened the convention, and in all about forty papers were read over a period of three days, most of them in

English, but some in South Africa's other official language, Afrikaans. The series of extremely interesting papers dealt with a wide variety of technical and professional subjects. All the papers read have now been published in the *Transactions* of the South African Institution of Civil Engineers.

At the time of the convention, an exhibition of outstanding photographs of African engineering projects was held in the foyer of the Johannesburg Public Library. Among the exhibitors were some leading local consulting engineers including Nihnam Shand, of Cape Town, and Stewart, Sviridov, and Oliver of Johannesburg. The pictures attracted not only technical but considerable public attention.

## The Kariba Dam

The highlight of the convention was a conducted tour of the half-completed Kariba Dam in the Central African Federation. The 420-ft high, 80-ft thick concrete arch on the Zambezi River will form the world's largest man-made reservoir. M. Andre Coyne, French consulting engineer and a member of the joint group of Gibb, Coyne, Sogei, Limited, handling design and supervision of construction on the giant complex, was a guest of honor at the convention and accompanied delegates to the dam site. Over a period of 30 years, M. Coyne has designed nearly 100 dams throughout the world. He is a past president of the International Commission on Large Dams.

Sir Alexander Gibb and Partners (Africa) Limited, consulting engineers, already are busy surveying and designing three harbor sites on the lake, which ultimately will inundate 2000 square miles of African bush. The temporary floodgates have now been sealed in the dam wall and the lake, which in all probability will be named Lake Eliza-

beth, for Queen Elizabeth II, is beginning to form. In parts it is expected to be 350-ft deep while in certain areas, islands are expected to protrude above it.

It is anticipated that lions and elephants will be trapped on some of these islands, and while the elephants will be able to swim to the mainland, something will certainly have to be done about the king of beasts, who cannot swim.

Almost 1500 Europeans and 7000 natives are employed at Kariba with another 2000 Europeans and natives occupied elsewhere on ancillary work such as brush clearance.

### How Much Does Earth's Crust Sag?

Under the weight of the 2000 square miles of water, the floor of the valley in which the lake will be formed is expected to sag. A unique scientific experiment will be conducted in an effort to determine how much the earth's crust sags under this heavy load. The latest annual report of the Director of the Federal Trigonometrical and Topographical Surveys, Brigadier M. O. Collins, says that distortions occur in the earth's crust as a result of the filling of large lakes but records are insufficient to provide precise evaluation.

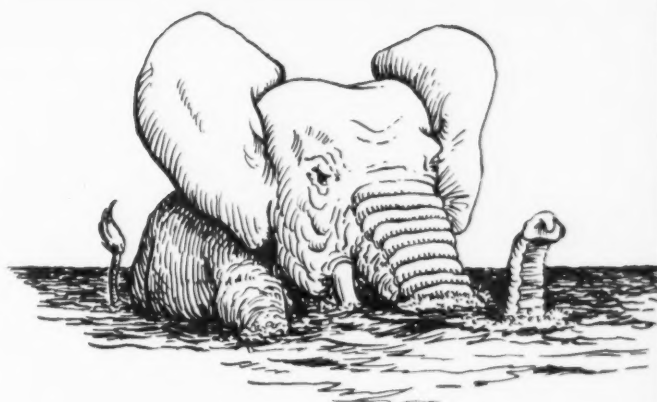
The report adds: "It is hoped, however, that it will be possible to plan a more precise scheme of records for Kariba, so that it will be possible to measure the distortion of the earth's crust due to the filling of the lake, thus providing scientific and engineering data which could not be obtained in any other way, anywhere else in the world."

M. Andre Coyne stated that minor earthquakes also might occur at about the time, two to four years from now, when the dam will have been completely filled.

### Ghana's Volta Project

In Ghana, West Africa, the Volta Project is still a household word, particularly since Prime Minister Dr. Nkrumah paid a three-day visit to Washington to see President Eisenhower about it. For the time being the United States and Ghana will share the expense of bringing the 1955 Volta Project engineering reports up to date... Later, Ghana hopes to get at least part of the \$500 million for the scheme from the United States. The scheme, which has been shelved more than once, involves damming the Volta to produce 600,000 kw which then will be used to smelt 210,000 tons of aluminum from Ghana bauxite each year. The Henry J. Kaiser Company is interested in this project and recently sent a seven-man team to Ghana.

No continent is today as dam conscious as Africa, and there is hardly a country where dams are not being built, designed, or at least planned. In Ugan-



da, for example, twenty-one times as much electricity now is being used as ten years ago. Generation of power, which once depended on a wood fired steam plant and diesel station, is now almost entirely from the Owen Falls hydroelectric station. Eventually the capacity of this station will be 150,000 kw. By 1965 the resources of the Owen Falls Dam will be fully utilized and by 1960 a second dam will have to be built. During this year, the Uganda Electricity Board's consulting engineers started designs for a 180,000-kw hydroelectric station to be erected at Bujagali, four and a half miles downstream from Owen Falls. Many other possible hydroelectric sites are being considered in this 94,000 square mile territory, of which 13,680 square miles are open water.

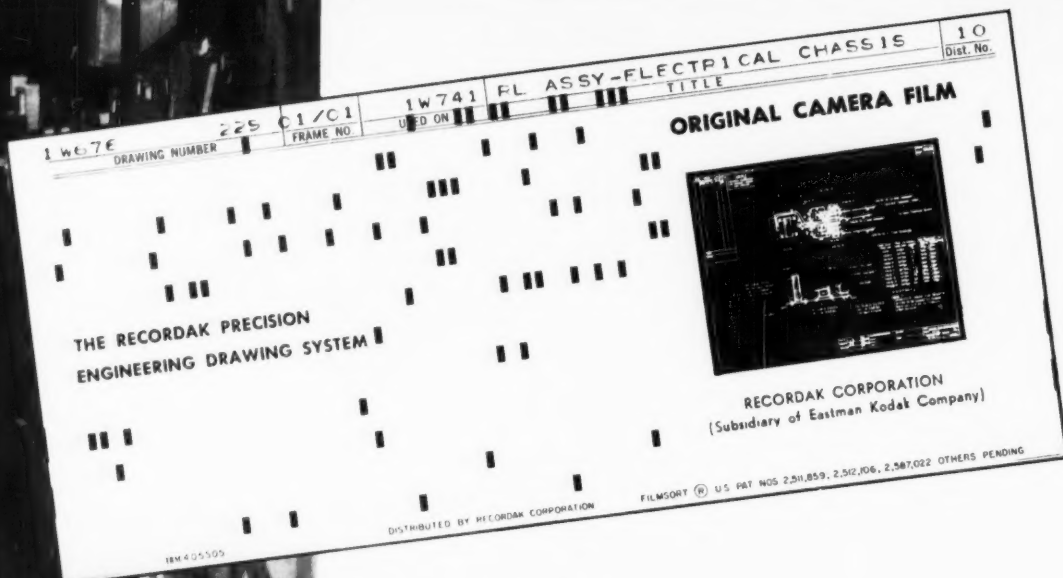
### The Aswan Dam

In North Africa, Nasser is giving serious thought to the much talked about Aswan Dam, which consulting engineers state will cost between \$1.2 and \$1.5 billion; a staggering amount which dwarfs Russia's loan of \$100 million. Nevertheless, five members of a Soviet delegation have just arrived in Cairo to study the Aswan Dam project.

From an engineering point of view the dam could certainly be built, but political implications may never permit the realization of Egypt's ambitious dream. Building this dam would entail the flooding of a considerable slice of Sudanese territory. The Sudanese government will not permit this, and instead is considering building its own dam. A technical team sent to Sudan by the World Bank is now in Khartoum.

Ethiopia, too, is thinking of building its own dam on Africa's longest river, the Nile.

All over the continent, new engineering projects are being planned and executed, slowly raising the living standard of its more than 200-million people. Consulting engineers are playing no mean part in this gradual lifting of the continent to a higher living standard. ▲▲



## We Put Our Records & Drawings On Microfilm

CHARLES GEORGE SCHNEIDER

Ford, Bacon & Davis, Inc.



RECENTLY, when we began planning to move our home office to new quarters in New York, we took a hard look at some 8-million documents accumulated during the firm's 64 years of practice. Company policy required that records be maintained in different classifications ranging from "permanent" down to 20, 10, and 5 years, and these records were taking up 10,000 square feet of warehouse space.

To solve the problem we took a cue from our subsidiary, Ford, Bacon & Davis Construction Corporation in Monroe, Louisiana, which some time ago found itself with more records than space. So it began microfilming correspondence, working papers, and accounting records on 16 mm film, with very satisfactory savings in storage space, plus ready accessibility to the records.

We set up a similar microfilming program in our home office to put accounting, correspondence, and

*Charles George Schneider holds a B.S. in Civil Engineering degree from N.Y.U. (1934). After one year with M. R. Scharff, Consulting Engineer, he joined Ford, Bacon & Davis, Inc. to conduct valuations, appraisals, and studies for electrical utilities, natural gas pipelines, and industrial and transportation operations. He has been project engineer on a number of natural gas compressor stations and construction project manager for industrial and petrochemical plants. Schneider is presently construction office engineer. He is registered in Louisiana, West Virginia, and Mississippi.*

other job records on 16 mm film, and to photograph engineering drawings on 35 mm film.

Within a few months, we will have our history of records, right up to current projects, on microfilm. Warehouse space, which had been packed from floor to ceiling with records of all shapes

and sizes, has been subtle, and the rent from this space offsets part of the microfilming cost. All our microfilmed records now can be stored in our own office in the equivalent of three standard 4-drawer legal-size filing cabinets.

Although putting our records on microfilm saves rental on warehouse space—and in New York City such space is scarce and costly—we do not consider this the greatest advantage of our new record system. For us, the biggest saving will be in time.

#### **Time Delay**

Formerly, when we wanted to refer to a past job or engineering record drawing, a messenger had to go to the warehouse some eight blocks away. This meant a delay while we waited for the messenger to return with the information. While this was bad enough, all too often the person who required the material had to go to the warehouse himself to search for it, a costly procedure when you consider time taken from productive work. Now with all our records on microfilm and stored in our own office, any member of the staff can refer to them immediately.

In addition, we do not have to worry about valuable records becoming brittle and unusable with age, the usual result of long storage in a warehouse lacking atmospheric conditioning.

Another major saving will be mailing costs, particularly when transmitting drawings. Microfilm can be air mailed to our subsidiary, branch, and field offices in small packages at minimum cost.

Our permanent offices in Chicago, Los Angeles, and Toronto, and our field offices, located near major cities in the country, can have all their project records, including drawings, microfilmed, and the reels sent to the home office for storage. Previously this required bulk express shipments of the original sheets. Moreover, should any records be lost or destroyed in transmission, duplicate microfilm copies can be made quickly from the originals in the home office.

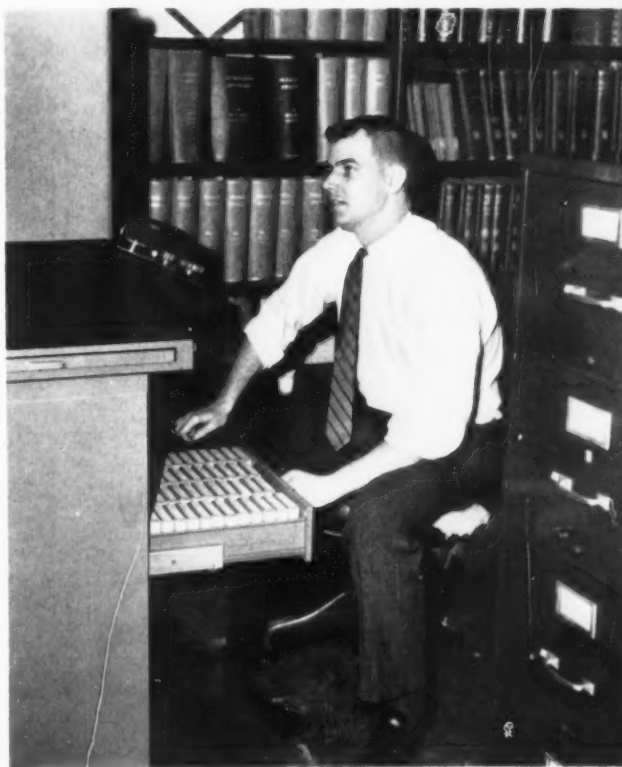
#### **Record Check**

We did not microfilm all of the 8-million individual records we had at the beginning of this project. A small group of employees, working under key personnel, was detailed to screen the records to remove all extraneous matter. They reduced the number of documents to 3 million.

Our microfilming operation was divided into two parts. The first part covered records, job working papers, and correspondence. These were photographed on 16 mm film by our own employees, using four microfilm machines set up in our warehouse. One of these machines was purchased and three were rented from Recordak on a monthly



*Engineering drawings are microfilmed 35 mm size and mounted on key-punched IBM aperture cards.*



*Single 6-drawer cabinet stores 8-million documents on 100-ft and 200-ft reels of 16 mm microfilm.*

basis. We expect that one microfilmer will be able to handle the continuing program.

The exposed rolls of film were coded and indexed, then sent to Recordak for developing. We followed a special indexing system designed for microfilm for rapid identification. Developed films are stored in a steel filing cabinet adjacent to a microfilm reader. Our ultimate plan is to have two of these readers.

Just about everything left in our files after the screening, including specifications and other letter-size papers connected with engineering drawings, has been put on 100-ft and 200-ft reels of 16 mm film. Canceled checks, personnel records, and other documents having information on both sides can be photographed automatically on the microfilmer at the rate of approximately 400 exposures a minute by making a simple adjustment on the machine. Front and back images appear side by side on the individual frames of the film.

Any of the information on microfilm can be reproduced in the form of electrostatic prints by the Recordak company at the rate of about 200 prints an hour—at a fraction of the cost of photographing or other reproducing methods.

#### **Engineering Drawings Also Photographed**

The second part of our program was photographing our engineering drawings on 35 mm film. Our company policy is to retain engineering drawings for 20 years, so another screening job was necessary. We eliminated duplicate tracings, made sure that each job set of record drawings was properly indexed and in the proper order, then delivered them to Recordak for photographing. An index was photographed as the first exposure for each job set of drawings.

We had Recordak do this photography because a trained operator and precision equipment with reduction ratios up to 29 to 1 are required to assure reproduction of the detail found in engineering drawings. Exposure readings have to be taken for each individual original drawing.

Because our drawings were a mixture of original tracings, blueprints, and Ozalid reproductions, additional processing had to be done by Recordak to provide negative image microfilm records. All microfilm records should be negative images, so that when the projection of the film is viewed there is less glare and less eyestrain.

The engineering drawing microfilms are not stored in rolls. Instead the individual 35 mm frames are mounted on patented IBM aperture cards. These cards have the job number, drawing number, client, and location printed along the top edge and are key punched to permit manual or mechanical sorting and filing. A second set of positive images

is made from the original film negatives and is kept in roll form for security purposes only. They also can be used to reproduce additional negative films as required. These security rolls are to be permanently stored either in a bank vault or in a vault in the basement of our new building.

The aperture cards, which are used for day to day reference, are stored in our engineering department in a steel filing cabinet especially designed for IBM cards. When we move to our new office space, we plan to purchase a large projector designed to project the microfilm images on a viewing screen in full original size. This will be adequate for most of our reference work.

When paper reproductions are needed, they can be made up in any quantity from the aperture cards, at actual drawing size or smaller. We also can obtain prints made on full-size vellum, which can be used to permit production of standard blueprints or Ozalids. The most inexpensive reproduction offered by Recordak, and preferred by our engineers, is an 11-in. x 17-in. electrostatic copy that can be made automatically. This is a handy readable size when the drawing is used for reference.

We now have 20,000 drawings on microfilm. Original drawings other than those furnished to clients by contractual agreements are destroyed after microfilming.

The tremendous variety and size of documents on microfilm slowed up the project to some extent. Colored paper forms slowed production until automatic exposure controls were installed on the cameras. But the entire program is expected to be completed shortly.

#### **No Reduction in Personnel**

We do not expect our microfilming operations to make any noticeable change in personnel. Under the warehouse system, we had one employee at the warehouse, with messengers to transfer records. With the microfilming completed, we will have one employee responsible for the operation of the 16 mm camera.

The 16 mm microfilm rolls will be filed in our general filing department. The engineering record drawings on 35 mm film will be under the control of our present engineering department file clerk.

What size consulting engineering firm can benefit from a records microfilming program? This depends largely on the policy of the consulting firm with regard to keeping records, and the extent they value and use them. And the storage problem grows in proportion to a firm's age and activity.

Microfilming to us will mean a decided saving in time on the part of our personnel as our voluminous records and drawings will always be conveniently accessible for reference. ▲▲



## How you can be sure to get the capacity you pay for in a cooling tower...

Thousands of gallons of water pour through a cooling tower every minute. If it goes in hot and comes out cold... if it keeps a plant's process water reasonably cool—is it safe to assume that the tower is doing its job... that the owner is getting his money's worth out of it?

Definitely not!

A tower may actually be operating at only a portion of the capacity paid for—without the owner's knowledge. Its heat transfer efficiency may fall short of specifications. Operating horsepower requirements may be higher than they should be.

How can you tell?

By conducting thorough field performance tests. But if the tower proves deficient, you can correct it only by increasing horsepower or the size of the tower—or both. Even though the manufacturer stands behind his product, you are put to additional expense, you may lose valuable production because of down time during the reconstruction, and your operating power costs may be increased for the entire life of the tower.

Obviously, the best thing is to know the capacity before you buy.

How? Well, you can accept the manufacturer's guarantee. But how

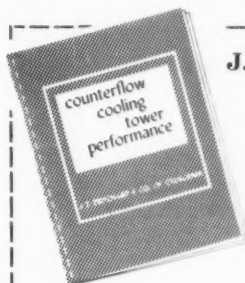
many manufacturers *really* know? Determining the capability of a cooling tower is an exacting science, requiring highly specialized knowledge of a wide variety of factors influencing performance.

Portions of such knowledge have been published in the past but much has been retained by cooling tower manufacturers as "private and confidential" data. But now, Pritchard has gathered all this information, refined it, added to it field-tested findings from our own research facilities, and arranged it into usable form. This reservoir of knowledge has been published under the title, "Counterflow Cooling Tower Performance," and is avail-

able from Pritchard for \$3.00. For your copy, mail the coupon below with your check or money order.

No book alone, however, can guarantee cooling tower capacity. That is the responsibility of experienced Pritchard engineers, who translate the information contained in the handbook into cooling tower designs that give you performance, not promises... real long-run economy, not first-cost-only economy.

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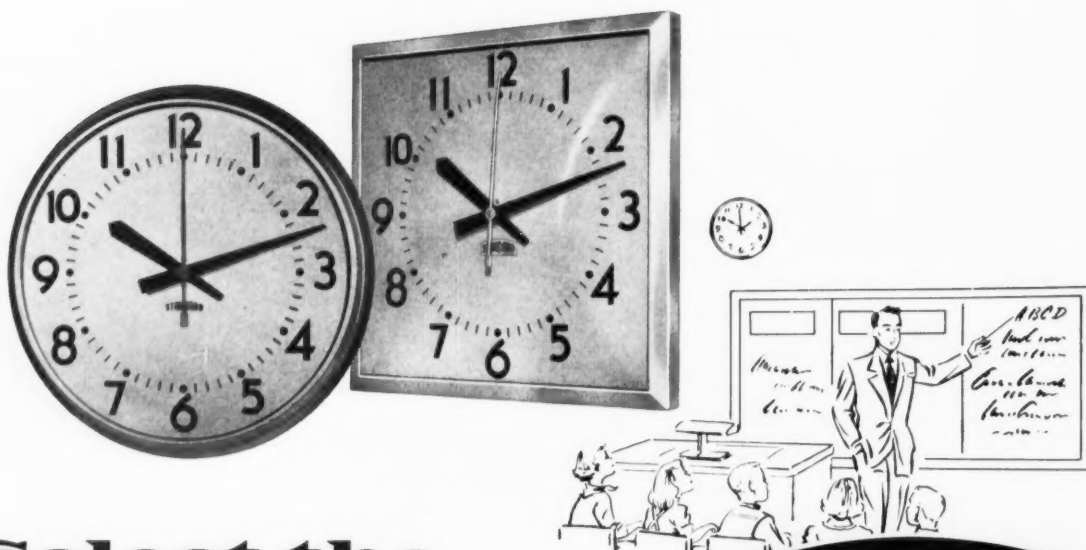
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## A Careful Comparison of Professional Liability Policies



HELEN KELLER

*Helen Keller has been active in the insurance business since 1935. She is now an insurance broker operating her own office. Her keen knowledge of professional liability insurance—a field in which she specializes—developed from discussions with many engineers. Through these discussions Mrs. Keller became aware of the individual problems facing consultants and learned that each firm has its own specific professional liability coverage requirements.*

MANY ENGINEERS are not aware of the wide scope of coverage afforded by professional liability (errors and omissions) insurance. This insurance is not limited to coverage of claims by the owner of a project. It can be extended to cover any claim based on a negligent act, error, or omission in rendering or failing to render professional services as an engineer—with the exception of claims arising from nuclear fission or radioactive contamination and work in connection with nuclear facilities.

Claims based on errors or omissions or faulty plans and specifications are excluded on the regular liability insurance policy of the engineer, which covers his premises and operations. Professional liability insurance fills this gap.

Everyone is familiar with the obvious type of error or omission involving soil failure, structural error, or erroneous boundary survey, but there are many other types of claims that could arise.

**Bodily injury claims.** From all indications, damage suits have become a big business. People are suing each other for larger sums and for a wider variety of complaints than ever before. Today an accidental injury is viewed by many as a golden opportunity to harvest a windfall—all the more so because verdict money is tax-free. If someone is injured through an alleged error on your part, the jury undoubtedly would be more sympathetic toward the injured party than toward you. If the jury were composed of engineers, this might be a different matter. Those of you who have served on a jury know that many factors influence a final decision.

In a case of this type, your regular liability insurance would not cover you because the claim would be based on error. Coverage for an accidental injury claim based on error or omission is one of the most important benefits afforded by professional liability insurance. As an example, in a disaster-type accident such as a boiler explosion in a crowded

school building, the mechanical engineer could have a real fight on his hands whether he was guilty of error or not.

*Injured employees of contractors.* During construction, if an employee of a contractor is injured, he will be compensated through workmen's compensation insurance. However, there is nothing to prevent him from also suing the engineer, alleging faulty plans, specifications, or supervision.

*Loss of use.* The consulting engineer could be faced with a situation where the owner of an industrial building might allege that he had to shut down his plant to correct faulty work by the engineer. He might make a claim against the engineer for the corrections and for the loss of use of the plant as well, which could represent thousands of dollars a day in operating loss.

*Subrogation claims.* Many insurance policies contain a subrogation clause which provides, in effect, that if an insurance company pays a claim, all rights of recovery involving the claim are transferred to the insurance company by the insured. Workmen's compensation, liability, automobile, and fire policies contain subrogation clauses for all or part of the claim. Even though all types of claims are not subject to recovery, it is easy to see that subrogation claims by insurance companies could be a hazard to the consultant, particularly under insurance policies held by clients and contractors.

For example, statistics show that about 10 percent of all fires in the United States are caused by the "misuse of electricity." When a large fire loss is sustained by an insurance company, they explore every possibility in trying to recover their loss from the party who is legally responsible for the fire. If it should develop that the faulty drawings or specifications of the electrical engineer caused a building to burn down, the fire insurance company might very well make a claim against the engineer for their loss. They have the right to do so under the client's fire insurance policy.

*Damage to expensive equipment.* Suppose that an engineer, because of faulty specifications, is responsible for the damage of certain expensive machinery. His professional liability insurance then acts as a financial guarantee that he has the funds to cover any damage resulting from his error or omission. The engineer may be legally liable to make good the damage incurred, but without the insurance he might be financially unable to do so.

Many other examples could be given involving bodily injury, property damage, loss of use of property, and the job itself. Any claim based on faulty plans or specifications would be excluded under your regular liability insurance and would be covered by professional liability insurance — except, as stated previously, claims arising from

nuclear fission or radioactive contamination and work in connection with nuclear facilities.

### The Three Sources

Engineer's professional liability insurance is now available through three insurance sources. They are Lloyd's, Continental Casualty Company, and Fidelity and Casualty Company of New York. The Continental policy has been approved by the American Institute of Architects and the National Society of Professional Engineers. The Fidelity and Casualty policy has been approved by the Consulting Engineers Council for their members. There are no group policies issued by either of these companies, each policy being issued individually on the basis of a completed application. Neither do these companies allow discounts to engineers if the insurance is purchased through any particular brokerage firm.

Some of the differences between the Lloyd's contract and the two domestic contracts need to be brought out. An impartial comparison is given in the answers to the following questions.

*Whose errors are you, as an engineer in private practice, insured against?*

Lloyd's indemnifies you against any claim due to a negligent act, error, or omission committed by you, your employees, or any architects and engineers you may retain.

The domestic policies will defend any suit or arbitration proceeding that alleges an act of negligence, error, mistake, or omission, whether committed by you or by others for whom you are legally responsible, and will pay all sums which you are legally obligated to pay.

In other words, the Lloyd's contract indemnifies you if you are obliged to pay a claim, whereas the domestic policies defend you and pay legal claims. As a matter of fact, Lloyd's designate their policy as "Professional Indemnity Insurance" and the domestic policies are called "Professional Liability." *Are all prior acts of the insured covered?*

All three policies can be written to cover prior acts of the insured.

If the insured is a corporation, the policies can be endorsed to cover prior acts of the officers before formation of the corporation. If the insured is a partnership, prior acts of the individual partners before formation of the present partnership can be covered. In fact, the Fidelity & Casualty policy now automatically provides prior acts coverage for individual partners prior to formation of the present partnership. It is not necessary to endorse the policy for this purpose.

*Where must the error or omission occur?*

The Continental policy provides that the error or omission must occur within the United States,

its territories or possessions, or Canada. If you do foreign work and have engineers located outside of the areas mentioned, this policy is not suitable for you unless it can be endorsed to include foreign coverage. However, if you have an occasional foreign job, and an error is made on your drawing boards in your office in the United States or the other areas mentioned, the Continental policy does provide coverage.

Fidelity & Casualty's policy now provides for errors which occur outside of the United States, its territories or possessions, and Canada, provided the claim is initially made or suit to recover is originally brought within the continental limits of the United States. However, no coverage is provided if a suit is brought in the U.S. which seeks to enforce, collect, or execute or is in any way connected with a judgment obtained in a foreign jurisdiction.

Lloyd's give world-wide coverage.

*What are the minimum and maximum amounts of professional liability insurance coverage available?*

The minimum amount written on all policies is \$25,000, with \$500 deductible.

At the present time, the domestic companies will not write more than \$250,000 of insurance for any firm. Lloyd's, of course, will write higher limits. How high they might go would depend on the underwriting factors involved.

*Are the legal costs and expenses in connection with a claim subject to the deductible?*

The domestic policies pay legal costs and expenses in addition to the limit of the policy. The deductible does not apply to these expenses. In other words, legal costs and expenses are paid from the first dollar.

On the Lloyd's policy, the deductible applies to each and every claim, which includes legal costs and expenses.

As an example, suppose you have a claim involving \$1000 of litigation costs, and the case is settled in your favor without any payment. You are carrying \$500 deductible insurance. Under the Lloyd's contract you would pay the first \$500. Under the domestic policies you would pay nothing.

*Does the basic policy insure liability arising from supervision of actual construction?*

Under the Lloyd's policy, liability arising out of supervision of actual construction is not included unless the policy is endorsed. In this regard, many engineers feel that instead of a charge being made, a credit should be given, as they believe there is much less chance for error when the construction is supervised by the engineer who designed it. It is interesting that this exclusion does not appear on the domestic policies. However, Fidelity and Casualty does make a charge for this coverage whereas Continental does not.

*Does the basic policy insure liability arising from activities in connection with projects involving fairs or exhibition grounds?*

The Lloyd's and Continental policies exclude liability arising from activities in connection with fair or exhibition grounds unless a charge is made and the policy endorsed.

The Fidelity and Casualty policy excludes liability arising out of operations in connection with fairs or exhibitions except for liability with respect to permanent structures erected in connection with fairs or exhibitions. Briefly, liability in connection with permanent structures is covered under the Fidelity and Casualty policy.

*Does the basic policy insure liability arising out of the making of boundary surveys, subsurface surveys, and ground testing?*

All three policies exclude these activities unless the policy is specifically endorsed.

In many instances engineers make their own soil determinations for minor structures where a soil report does not seem necessary. To be covered for this type of soil failure, the engineer must have his policy endorsed to include this hazard. The extra cost is nominal for the coverage afforded.

In this connection, bear in mind that if you retain a soils engineer, you have a contingent liability for his errors and omissions. This also applies to other engineers and architects you might retain.

It seems to be a well-established procedure for the owner to contract directly with the soils engineer and boundary surveyor.

*Does the basic policy insure liability arising out of operations in connection with projects involving tunnels, bridges, and dams?*

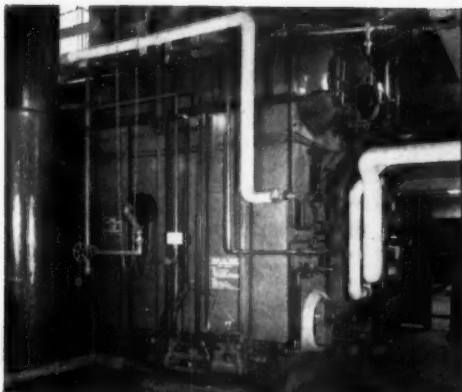
All three policies exclude tunnels and bridges unless the policy is endorsed. Exceptions are Continental's provision stating that pedestrian tunnels and pedestrian bridges not over 150 feet in length and utility tunnels not over 150 feet in length are included in the basic policy; and Fidelity & Casualty's basic policy coverage for liability in connection with bridges and tunnels not exceeding 150 feet in over-all length.

However, the Continental policy excludes coverage for activities in connection with dams unless the policy is endorsed. This exclusion does not appear on the other two policies.

*Does the policy insure liability arising in connection with projects involving nuclear fission or radioactive contamination?*

None of the policies provide this coverage. Neither will a company provide legal defense for a claim based on an occurrence which is specifically excluded.

If your firm deals with nuclear facilities, you should check with your client to see if he is in-



A 15,000 lbs/hr unit in a boxboard plant



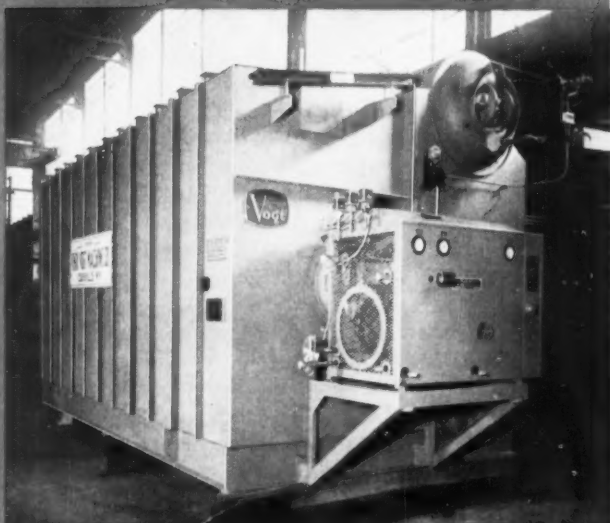
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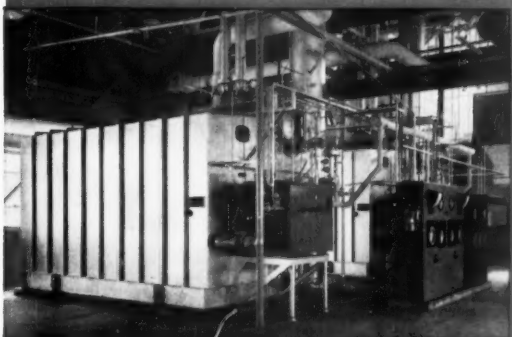
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sured and to determine whether you can be included in his insurance.

*In order to comply with the conditions of the policy, when must you give written notice to the company of a claim?*

The domestic policies provide that written notice must be given to the company when you become "aware" or "receive information" of any act of negligence, error, mistake, or omission. One mechanical engineer stated that if he reported every beef to the insurance company, he would have to hire another girl just for that purpose. On the other hand, he did not want any claim denied on the basis that he did not notify the company when he became aware of it. In the absence of a specific example, a company cannot state which occurrences should be reported and which should not. However, it is not the practice of responsible casualty companies to pick on a technicality of this nature to deny coverage — unless something unusual (such as collusion) is suspected.

The Lloyd's policy requires that you give written notice to them of any claim made against you or of the receipt of notice from any person of an intention to hold you responsible. Under this policy you are not required to give notice when you become aware or receive information of an occurrence, but only when a claim is made against you or when you receive notice from someone of intention to hold you responsible.

*Can claims be settled without your consent?*

Neither Lloyd's nor the domestic companies can settle any claims without your consent. However, if you do not consent, and you wish to pursue a claim further, they will not pay more than they could have settled for up to the date of your refusal. Incidentally, all claims must be referred to the insurance company. You cannot settle your claims yourself and send them the bill.

*How are the premiums determined?*

Basically, premiums are computed on the number of principals in the firm, size of staff, volume of construction values, and the type of engineering done. Application must be made for a premium rate. Premiums can be reduced by increasing the deductible amount.

Inasmuch as there is no coverage for work in connection with nuclear facilities, the firm who engages in this type of engineering along with other work should show separately on their application the construction value of their nuclear projects and the percentage of their staff working on these jobs.

#### **Basic Value of Liability Insurance**

Bear in mind that when a suit is brought it is considered good legal practice to name everyone connected with the claim, and if you are included you

must provide your own defense even if the claim is groundless, false, or fraudulent. In this respect, the engineer is particularly vulnerable because he could be included in suits involving architects, contractors, subcontractors, owners, and other engineers. Needless to say, many claims can arise over which the engineer has no control and in connection with which he made no error.

A professional liability insurance policy is a vehicle for pegging business costs. This is its basic value. When an engineer buys the domestic insurance he guarantees to himself that his legal costs and expenses due to any possible claims will not exceed his premium for the coming year. In addition to this tremendous advantage, his claims are paid up to the limit of his policy if he should be so unfortunate as to have a claim. If he never has a claim, the premium he pays is equivalent to a retainer fee for legal services.

When he buys the Lloyd's policy he knows that besides his premium he will not pay more than the deductible amount on each and every claim during the policy year.

#### **Skepticism Unwarranted**

Some engineers feel that the widespread purchase of this insurance will skyrocket future premiums, and they point to automobile insurance as an example of what could happen. There are many factors which have contributed to the rising cost of automobile insurance. Increased horsepower, higher cost of automobiles, new designs which make relatively small damages expensive to repair, crime, juvenile delinquency, increased alcoholism have all made their contributions. On the other hand, in insuring a professionally qualified engineer, who is at the same time a sound business man, there are few outside factors that affect his operations.

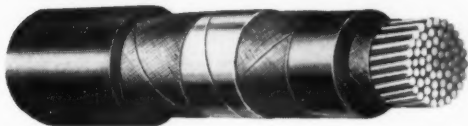
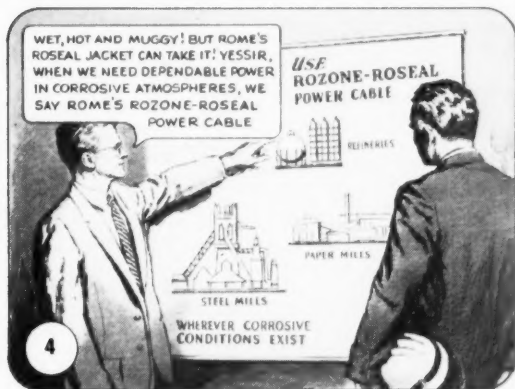
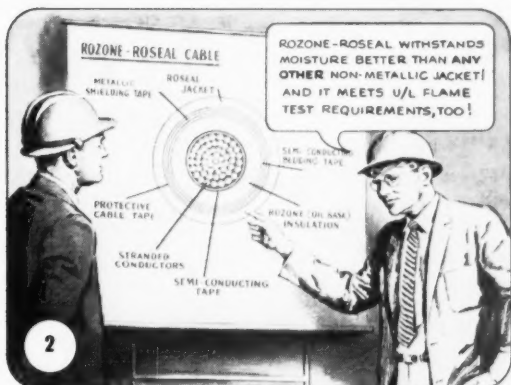
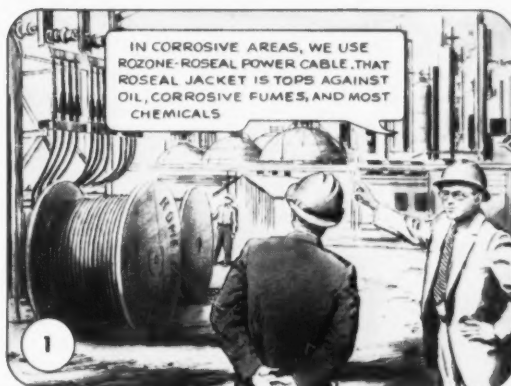
Professional liability premiums have decreased in the past few years. In a comparatively new field of insurance when more people buy the coverage there is less selection against the company which usually results in lower future premiums. It would seem that if professional standards remain at today's high level, future premiums should continue to decrease.

Others feel that this insurance is going to promote carelessness. Needless to say, anyone who has too many claims will be canceled just like the person who has too many automobile accidents. Because of the limited market, anyone canceled for this reason will not be able to get insurance.

Still others feel that this insurance may be misused as an advertising or sales tool.

In spite of all the fears expressed, most engineers recognize the value of professional liability insurance and consider it a valuable asset. ▲▲

# DANGER! CORROSION AT WORK...



**Available in voltage ranges through 15 kv** Rozone-Roseal preferred power cable may be installed in air, conduit, underground ducts, or directly in earth. Your choice of premium ozone-resistant insulations: Rozone (oil-base) or Rozone A (butyl-base). For complete information, contact your nearest Rome Cable representative and ask for Bulletin RCD-700. Or mail the coupon today.

## ROME CABLE

C O R P O R A T I O N

### A matter of FACT

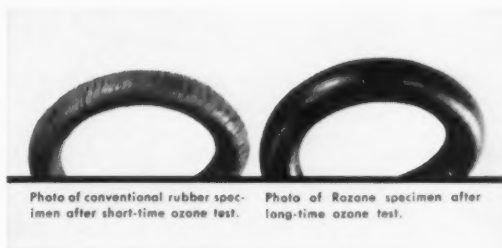


Photo of conventional rubber specimen after short-time ozone test.

Photo of Rozone specimen after long-time ozone test.

**Rozone insulation** is high in dielectric and impulse strength and has excellent resistance to corona and ozone cutting.

**FREE BULLETIN** describes the benefits of Rome's preferred high-voltage power cables.

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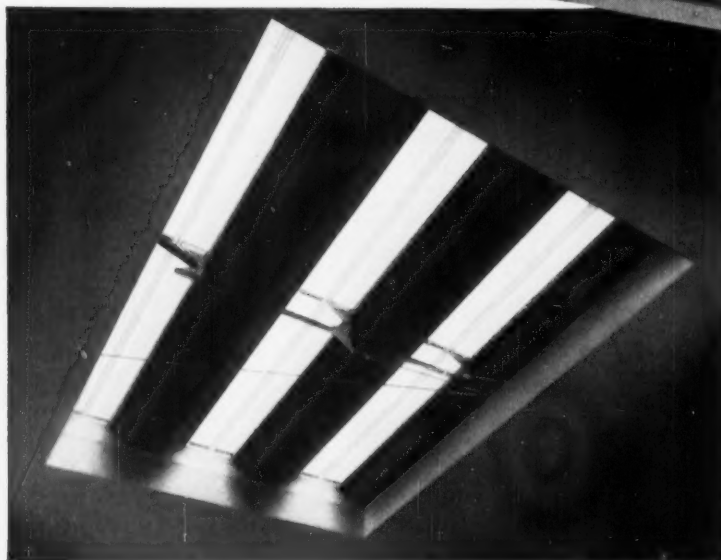
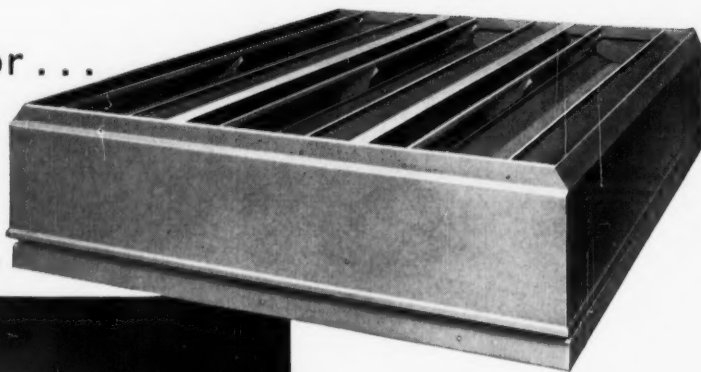
Company \_\_\_\_\_

Address \_\_\_\_\_

Type of business \_\_\_\_\_

It's a ventilator . . .

It's a skylight . . .



Patent No. 2,784,660

# NEW!

## Lite-'n-Aire

by

## Swartwout

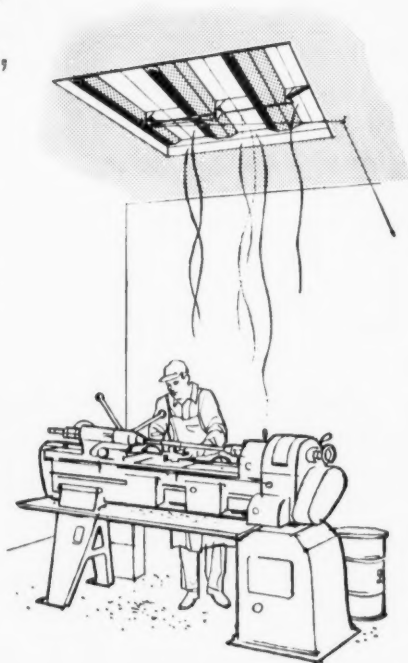
One unit, one installation,  
one cost!

- Strong, translucent Fiberglas\* dampers and gutters transmit soft, diffused light . . . no glare or hot spots . . . up to 12,380 candlepower with dampers closed, 16,450 with dampers open.
- High capacity gravity ventilator moves air silently and efficiently. Low 21" roof silhouette is inconspicuous from the street. 30 square feet of free opening provided by each standard unit.
- Extra safety — fusible link mechanism opens dampers automatically when temperature exceeds 212° F. to vent out fumes, smoke, flames. Light transmission prevents power failures from completely darkening buildings.
- Unique Lite-'n-Aire provides ventilation, skylighting and fire relief all in a single, economical unit. Two sizes — 7'6" x 10' and 5' x 5' — fit any situation.

These and many other advantages are all available **now** in the new Swartwout Lite-'n-Aire.

**Write for free 8-page folder now. Ask for bulletin CAM-3.**

**The Swartwout Co.**  
**Ventilation Engineering**  
18571 Euclid Avenue Cleveland 12, Ohio



\* TM Owens-Corning Fiberglas Corporation

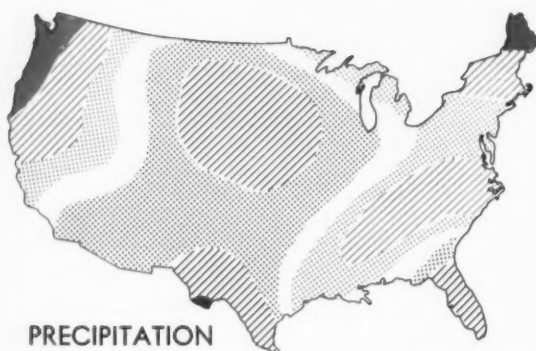
See Booth 222, International Heating & Air Conditioning Exposition.



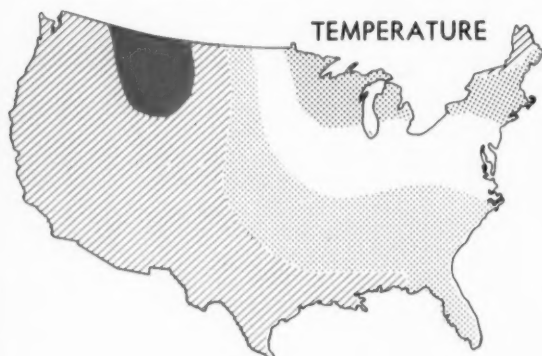
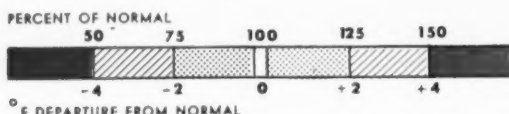
# KRICK WEATHER OUTLOOK

JANUARY 1959

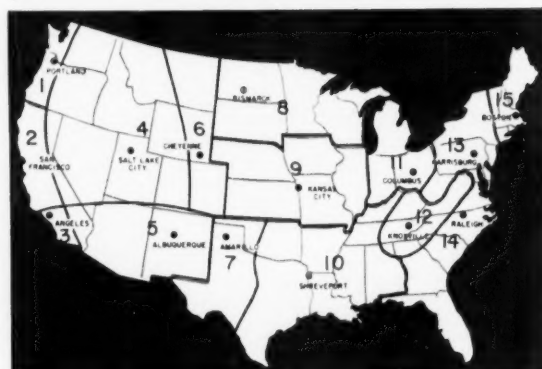
Prepared Exclusively for CONSULTING ENGINEER



PRECIPITATION



TEMPERATURE



CONSTRUCTION DAY FORECAST LOCATIONS

## CONSTRUCTION DAY CRITERIA

To be considered a construction day on these charts, the day's maximum temperature must be more than 38 degrees. There must be less than six inches of snow on the ground. There must be less than six hours of active precipitation between the hours of 7 a.m. and 5 p.m. There can be no more than one inch of rain on the preceding day.

## JANUARY HIGHLIGHTS

Repeated surges of Canadian air moving over the Great Lakes area will produce a colder than normal month from the Great Lakes eastward throughout the New England area. Elsewhere over the United States a mild January is in prospect with warmest weather relative to normal expected in the northern Rocky Mountain region. The most important precipitation areas are expected to be located along both coasts of the U.S., with the Pacific Northwest expected to be unusually wet. A broad band of wetter than normal weather also is expected to extend from the eastern Gulf Coast of Texas through most of the southeastern United States including the lower Ohio Valley and the Carolinas. In contrast to the wet coastal regions, the Rocky Mountain States, Great Plains, and Oklahoma-Texas Panhandle areas are expected to be much drier than normal. In relation to normal outside working weather, the January weather outlook this year indicates that the eastern third of the nation should expect more interruptions than normally experienced in January, especially throughout most sections of the southeast. The Rocky Mountain area extending from the Canadian border southward to the Mexican border is expected to experience more favorable outside working weather than usually anticipated in January, especially in the upper Plains states and most of Arizona and New Mexico. In the western half of the U.S. the most important cool weather will occur during the first half of the month; in the east cold air penetrations will be frequent, with the most important mild weather around the 20th.



TEAR OUT ALONG PERFORATION.

CONSULTING ENGINEER

These forecasts are prepared by Irving P. Krick Associates, Inc., the world's oldest and largest weather engineering firm. The forecasts are based on methods developed by this group at California Institute of Technology prior to World War II. After the War, the methods were adapted to high speed electronic computing machines to shorten the time required to solve the complex problems of the atmosphere. Ultra-long range forecasts, up to a year or more in advance, are now available. Information on other Krick weather services is available by writing to the home office of the firm at 460 South Broadway, Denver, Colorado.

## CONSTRUCTION DAYS

JANUARY 1959 ESTIMATES															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	30	30	31	24	31	26	30	15	21	29	16	28	28	29	16
LOWEST	4	20	23	0	16	1	13	0	8	18	1	15	1	18	2
AVERAGE	16	27	28	11	24	16	23	5	16	23	11	22	14	24	10
ESTIMATE	15	26	30	21	28	22	25	8	16	20	6	19	7	20	5

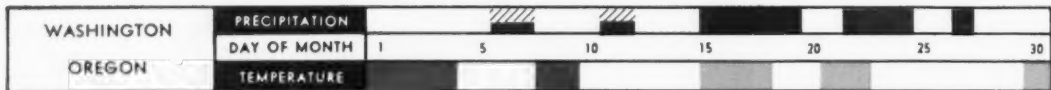
These estimated construction days for key cities in the United States should be interpreted as an average of estimated conditions over the forecast area. To obtain the best results, the forecast number of construction days should be compared with the temperature and precipitation anomaly maps and the timing estimates to determine the probable number of construction days in your locality. The forecast construction days are based on average construction day requirements as defined under "Construction Day Criteria," and should be adjusted for individual operations.

FEBRUARY AVERAGE AND RANGE*															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	26	27	28	23	29	23	29	10	26	28	22	26	24	28	15
LOWEST	10	22	21	7	21	8	20	0	9	18	5	15	10	19	8
AVERAGE	20	25	25	18	26	14	25	3	17	24	14	22	15	24	11

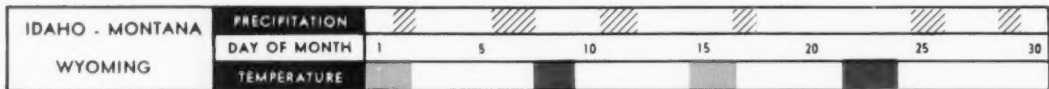
MARCH AVERAGE AND RANGE*															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	31	30	31	30	31	31	31	22	27	31	29	30	24	31	28
LOWEST	20	26	26	14	27	14	25	1	16	23	14	22	17	24	12
AVERAGE	25	28	29	25	30	22	29	9	22	28	21	27	22	28	19

\*Historical Average, Not a Forecast

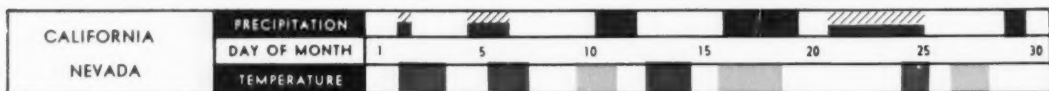
# JANUARY 1959 TIMING OF SIG



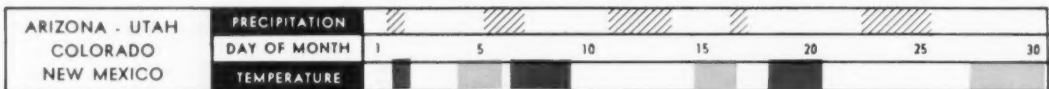
The first 10 days of January are expected to be colder than normal, but the last half of the month will have several mild periods. Several important storms are expected to produce above normal amounts of precipitation – up to one and one-half times normal in coastal areas.



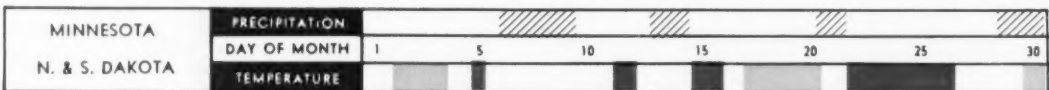
Below normal precipitation is on tap throughout most of this area. The stormy interval around the 12th should bring heaviest precipitation into southern Idaho and Wyoming. The cold weather around the 22nd should be most important in northern sections of Montana.



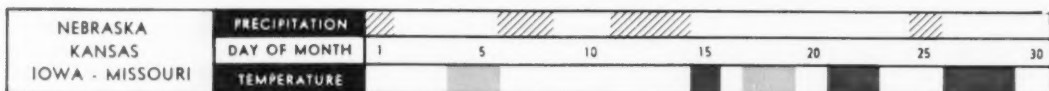
Above normal moisture accumulation is expected throughout most of this region with the exception of the desert locations. While no extremely cold spells are expected, freezing temperatures should be experienced at most inland locations during the indicated cold air outbreaks.



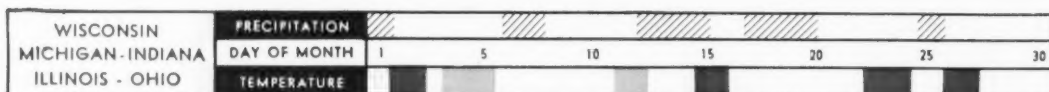
Mild and dry is the outlook for January. Storminess around the 5th is expected to be most important in Utah and Colorado. While frequent zero degree readings should be expected in the higher elevations, severe or prolonged low temperature readings are not expected at lower levels.



The stormy pattern indicated around the 13th or 14th of the month should be general with heaviest amounts in the southern half of this region. It will be well to look for the most prolonged cold weather during several days centered around the 24th.







Despite frequent storm activity, January precipitation should total less than normal. Considerable cold weather is expected during the last half of the month with the most intense cold centered in Iowa and Missouri during the last week.

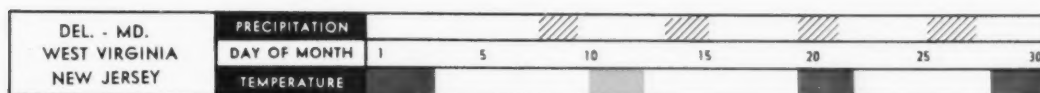


Frequent surges of cold, Arctic air are in prospect. Low temperatures should drop to near zero degrees frequently during the last 10 days of the month. An important storm is expected around mid-month. Look for mild, storm-free weather on a day or two around the 11th.

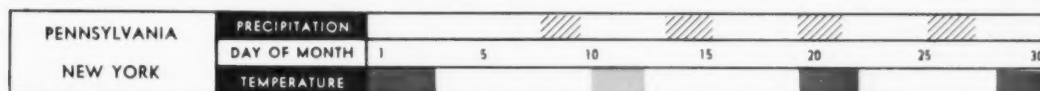
# SIGNIFICANT WEATHER EVENTS

RAIN	
SNOW	
WARM	
COLD	

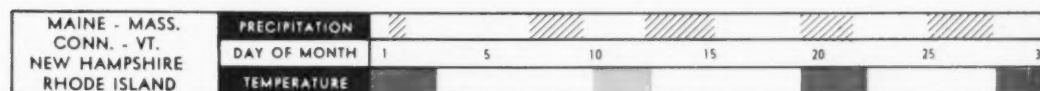
The timing bars below are intended to indicate periods of important general storminess and important departure from temperature normals in areas indicated. They are highly accurate over the area indicated, but are too general to pinpoint small local storminess or showers. Allow one day on either side of indicated storm or extreme temperature periods for general planning. Combination rain or snow shading indicates either one or both.



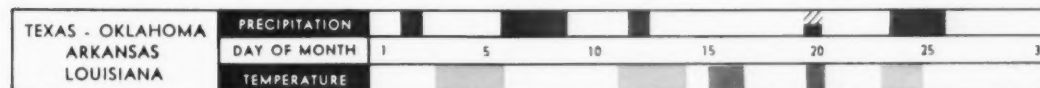
Unusually heavy amounts of precipitation are expected to accompany the stormy intervals indicated in the precipitation band for this region. An important storm accompanied by unusually cold temperatures is expected on several days around the 20th of the month.



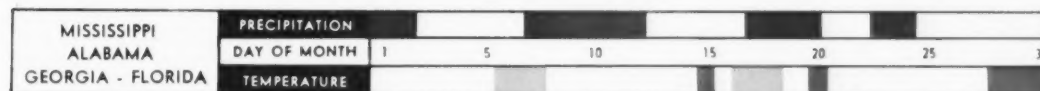
Heavy precipitation amounts will be associated with the storminess indicated. With a cold, wet month in prospect, this area should experience frequent construction delays. However, look for mild, storm-free weather on a day or two around the 12th.



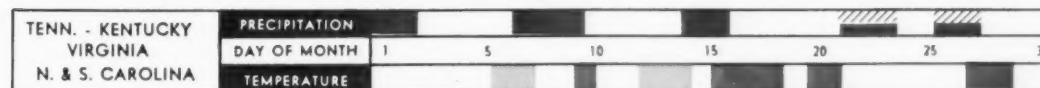
Expect frequent interruptions in outside construction as cold weather and frequent storminess will prevail. Several days around January 4th will bring the best storm-free, fair weather. The last 10 days should experience frequent cold weather and considerable snowfall accumulation.



Important storminess is expected around the 8th and again around the 25th. Although brief, the cold outbreak around the 15th will drop temperatures below 20 degrees. Stormy patterns will be heaviest in eastern sections and considerably lighter in the Texas-Oklahoma areas.



A prolonged stormy interval is expected to occur on at least four days centered around January 10th. Shower activity early in the month should be most important in the northern sections while storminess near the 19th will be heaviest in the southern areas except Florida.



From mid-month on, frequent cold air penetrations accompanied by repeated storms moving through the area will combine to produce extremely unfavorable weather conditions with important snowfall accumulation a serious threat, especially in the higher elevations.





## "A year ago, we couldn't have built like this on our limited budget"



Note the contemporary roof lines, the simple yet attractive facade of the Sioux Falls Transit Company's storage-service barn (above) in Sioux Falls, S. Dakota. The new 1-in 12 roof pitch of the Low Profile Butler Building System creates low, sweeping roof lines that blend well with most any type of architectural treatment.

Sounds crazy, doesn't it? Construction costs have been going up — not down! How could anyone build a wide, clear-span building like this today, for less than it would have cost a year ago?

The answer is simple. The Low-Profile Butler Building System — introduced less than a year ago — now makes it possible to clear-span up to 120 feet with pre-engineered, economically mass-produced Butler structural frames and roof system.

Yet, the Low-Profile Butler Building System is versatile. It gives you complete freedom to create a wide variety of buildings.

Now, you can afford attractive, spacious factories, prestige-type commercial buildings, or more utilitarian garages and warehousing facilities, even on limited building budgets.

For full details on the new Low-Profile Butler Building System, contact your local Butler Builder. He's listed in the Yellow Pages of your phone book under "Buildings" or "Steel Buildings." Or write us.



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**When a motor we installed  
single phased, —  
Fusetron Fuses saved  
our reputation  
and a \$200 rewind job**

*C. B. Meldrum, OWNER*  
MELDRUM ELECTRIC COMPANY  
HOUSTON, TEXAS

*Mr. Meldrum continues:*

"Recently I sent several of my men to install a 50 h. p. air conditioning unit for a customer.

"It seems that my man who wired the 200 amp. switch failed to tighten a lug. He just hung the wire on the lug and then forgot to tighten it.

"When the unit was started, it didn't take long for trouble to develop. The loose connection caused one Fusetron fuse to blow. The motor started to run single phased but before any damage could result the other Fusetron fuses protecting the motor also blew and shut down the motor.

"My company stands behind its work. If the motor would have burned up, we would have rewound it without question. I know this would have cost us at least \$200.

"What is important too, our reputation was saved and we have a satisfied customer. If the Fusetron fuses had not given us an opportunity to go back and do the job right before the motor was damaged, we would have been in a 'hot' spot."

**For safe, modern, money-saving protection install FUSETRON dual-element FUSES and BUSS Hi-Cap FUSES throughout entire Electrical System!**



**E. R. O'CONNER**  
BUSS FUSEMAN

**C. B. MELDRUM**  
MELDRUM ELECTRIC CO.

#### Why Fusetron Fuses Provide Safest, Simplest Way to Prevent Damage from Single Phasing

When single phasing occurs, the current in the remaining phase increases about 100%. (Theoretically 73% but change in efficiency and power factor makes it about 100%.)

This 100% overload on Fusetron fuses of motor-running protection size opens them and shuts down the motor.

Such dependable protection against motor burnouts from single phasing has never before been available.

#### You too, Can Get Safer, More Dependable and Money-Saving Protection with Fusetron Fuses

FUSETRON dual-element fuses provide 10 point protection against electrical troubles. This is unlike circuit breakers or ordinary fuses which, except in rare cases, protect only against short-circuits.

#### In Addition: Fusetron Fuses Require No Maintenance or Recalibration

They are calibrated at the factory by engineers. Once properly installed, they require no inspection or down-time necessary on mechanically operated devices. There are no hinges, pivots or contacts to stick or get out of order. Dust, corrosion or oxidation cannot increase a Fusetron fuse's capacity or lengthen its blowing time.

After years of inactivity, a Fusetron fuse will give the same safe, dependable protection if called upon to open as it would have on the day it was installed.

#### For Loads above 600 and up to 5,000 amps ... Use BUSS Hi-Cap Fuses

They have an interrupting capacity sufficient to handle any fault current regardless of system growth.

They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuit of origin.

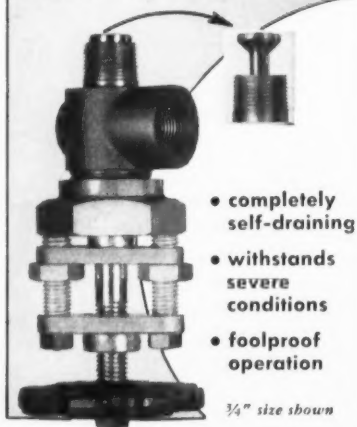
for more information, write for . . . Bulletin FIS on Fusetron fuses  
Bulletin HCS on BUSS Hi-Cap fuses.

BUSSMANN MFG. DIVISION - McGraw-Edison Co. University at Jefferson, St. Louis 7, Mo.



# New!

## Jerguson Drain or Sampling Valve



- completely self-draining
- withstands severe conditions
- foolproof operation

¾" size shown

The new Jerguson No. 23 Drain or Sampling Valve is completely self draining, for the valve stem seats on the outside of the valve body. It is ideal for installations where it is desirable to have the valve seat inside the wall of a vessel in order to prevent the typical condition of liquid remaining in the nipple and valve inlet.

This rugged, new Jerguson Valve has outside screw and yoke construction to meet high temperature or corrosive conditions where inside threads cannot be tolerated. The efficient outside thread design eliminates possible freezing and allows the valve stem to work freely at all times. The No. 23 Valve provides foolproof operation because the stem is constructed with a left-hand thread, thus allowing the valve handle to operate in the normal direction of standard valves.

Available in sizes from ¾" to 2" N.P.T. ¾" and 1" sizes are recommended for pressures of 4000 lbs. @ 100° F. and 1000 lbs. @ 750° F.; 1¼, 1½ and 2" sizes are recommended for 600 lbs. @ 100° F. and 250 lbs. @ 750° F. Optional features include construction with additional outlet for such uses as a steaming out connection and with a reamer on the end of the stem to break away encrusted matter which may have collected on the inside vessel wall.

Write for data unit and complete details.

### JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY

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Offices in Major Cities

Jerguson Tress Gage & Valve Co., Ltd., London, Eng.

Pétrole Service, Paris, France

## Field Notes

MARJORIE ODEN

Eastern Editor



THE LONG-AWAITED American Society of Civil Engineers' new fee schedule and manual of practice has been released. The new manual contains a considerable number of revisions, and a number of sections not included in the former Manual 29, published in 1951.

Manual 38, more than twice as long as the old Manual of Professional Practice for Civil Engineers, is quite explicit on many subjects merely touched upon before. It also includes in appendices a "Guide Form of Agreement for Engineering Services" and a "Guide Form of Agreement Between Engineer and Architect on Joint Services."

### Background of Program

The revisions on Manual 29 began two years ago, with the program expanded later to include highway fees at the request of Bertram Tallamy, Federal Highway Commissioner. The new manual—for some reason called Manual 38—includes an entire section on "Suggested Fees for Professional Engineering Services on Freeway Projects."

Louis R. Howson, former ASCE president and chairman last year of the committee preparing the manual, said ASCE hopes the new manual will be used for guidance by all public agencies employing consulting engineers.

A request by the Consulting Engineers Council for permission to assist in preparing the fee directory was turned down. However, an early announcement of the manual says it was prepared with the

cooperation of the American Road Builders Association and the American Association of State Highway Officials.

### New Fee Curves

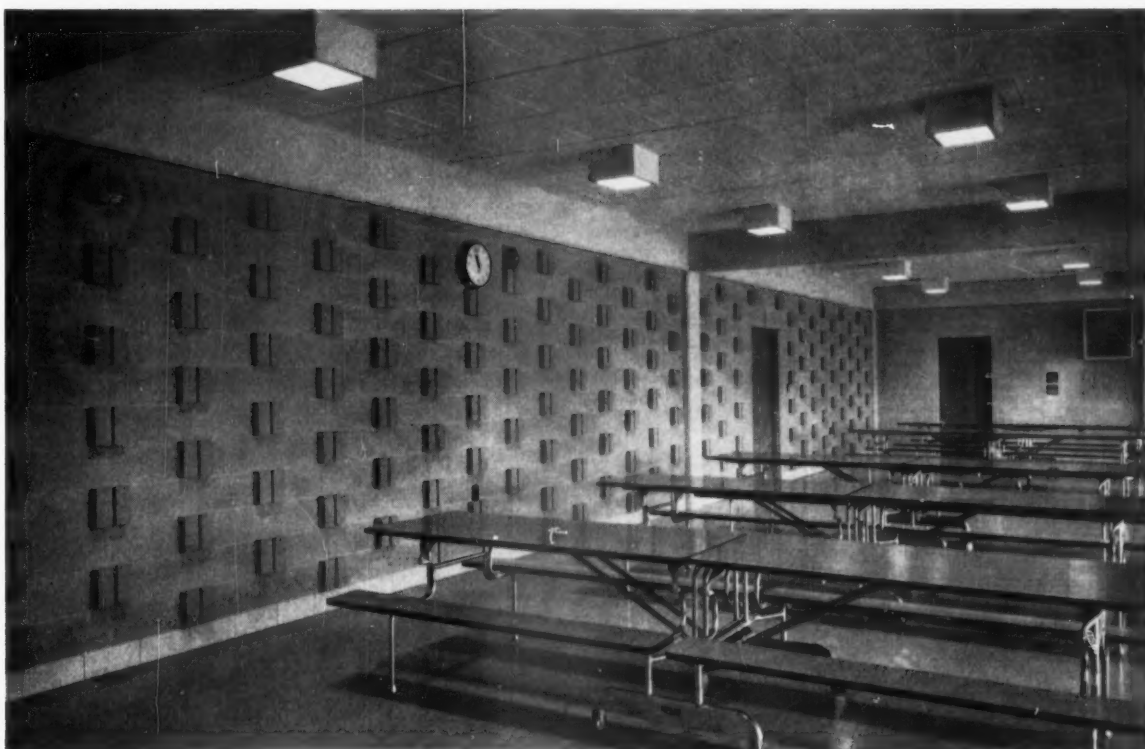
In a discussion of the new fee curves, Manual 38 points out that "the fee curves shown here are similar to, but not the same as, those in the superseded ASCE Manual No. 29. They are slightly lower at a construction cost of \$100,000, from 0.37 to 0.25 percent higher at \$1 million, and they have been extended to include construction costs up to \$100 million."

It adds: "The costs of all types of construction, with perhaps one or more exceptions, have increased substantially in the last 10 or 15 years. Engineering costs also have risen, and the percentage fees in this manual have been increased slightly above the fees shown in Manual No. 29. The increased percentage fees applied to the construction costs should compensate somewhat for the increased engineering costs. Construction costs of projects such as highways and conventional earth dams have risen a lesser amount due to the tremendous improvement of earth-moving machinery and the diminution of labor required. Such a lesser rise in the construction cost of such projects justifies an increase in engineering percentage fees in comparison with other projects."

The two fee curves—Curve A, for engineering projects of above-average complexity, and Curve B,

# **DUR-O-WAL<sup>®</sup>** SAFEGUARDS THE BEAUTY OF MASONRY CONSTRUCTION

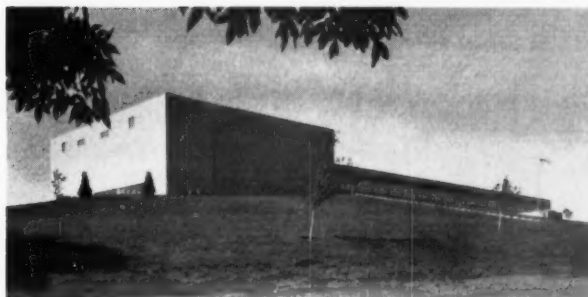
Throughout the United States genuine Dur-O-wal Steel Reinforcing is being used in the mortar bed to provide lasting protection for the classic beauty of masonry construction



You can provide timeless protection for the flawless beauty of masonry with time-tested Dur-O-wal. This high-

tensile steel re-inforcing is trussed designed and custom fabricated to give masonry walls a backbone of steel.

*Specifications and Research data available on request.*

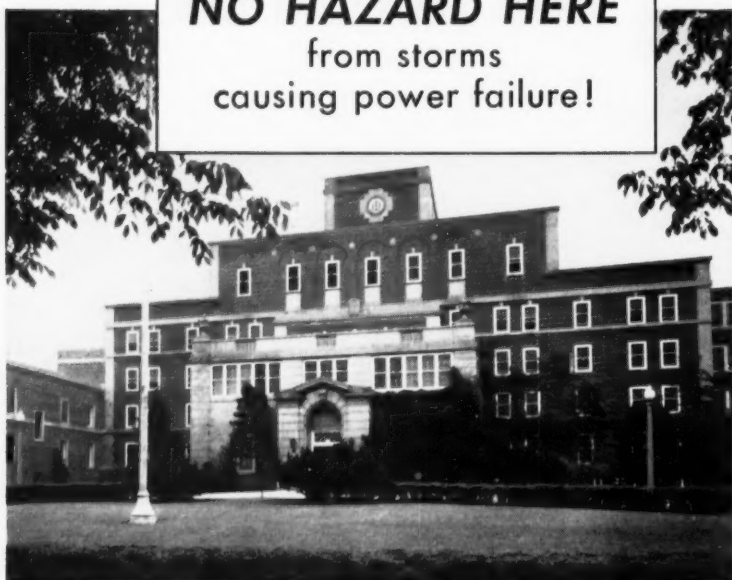


## **DUR-O-WAL<sup>®</sup>**

Rigid Backbone of Steel For Every Masonry Wall

Dur-O-wal Div., Cedar Rapids Block Co., CEDAR RAPIDS, IA. Dur-O-wal Prod., Inc., Box 628, SYRACUSE, N. Y. Dur-O-wal Div., Frontier Mfg. Co., Box 49, PHOENIX, ARIZ. Dur-O-wal Prod., Inc., 4500 E. Lombard St., BALTIMORE, MD. Dur-O-wal of Ill., 119 N. River St., AURORA, ILL. Dur-O-wal Prod. of Ala., Inc., Box 5446, BIRMINGHAM, ALA. Dur-O-wal of Colorado, 29th and Court St., PUEBLO, COLORADO Dur-O-wal Inc., 165 Utah Street, TOLEDO, OHIO

**NO HAZARD HERE**  
from storms  
causing power failure!



## Kohler Electric Plant safeguards Memorial Hospital

A 50 KW Kohler electric plant in this Sheboygan, Wisconsin hospital is ready to take over critical loads automatically—in emergencies when regular power

fails. Equipped with transfer switches and transformers, the plant will supply electricity for 115/230 volt single phase and 230 volt 3 phase normal service —insuring use of equipment vital to patients' care.

Kohler electric plants are thoroughly engineered package units, designed for specific purposes. They have all necessary features for easy installation, quick starting, quiet operation, minimum maintenance. Sizes to 100 KW, gasoline and diesel. Complete manual with suggested specifications sent on request. Write Dept. D-2.

**Model 50R51, 50 KW, 230 volt, 3 phase, AC.**



KOHLER CO. Established 1873 KOHLER, WIS.

# KOHLER OF KOHLER

Enameled Iron and Vitreous China Plumbing Fixtures • Brass Fittings  
Electric Plants • Air-cooled Engines • Precision Controls

for engineering projects of average complexity — are based on net construction costs at prices prevailing in 1957. Curve A has been approved, but Curve B had not received official ASCE approval by the time this issue of *CONSULTING ENGINEER* went to press. However, no changes were expected.

### Freeway Construction

The important new section on freeway construction stresses that "the suggested services and fees are for average highway projects. Large quantities of rock excavation, costly borrow in urban areas, swamp removal, and other items of this nature that would greatly increase the total construction cost, yet have little effect on the engineering services required, should be prorated to make a compensating reduction of the fee. On the other hand, the requirement of separate alignments and grades, the location of the project where topographic maps are not available, and other similar items that would require additional engineering services, yet not increase the total construction cost, should be prorated to make a compensating upward revision of the fee."

Basic minimum services are listed, with rural freeways considered a basic norm for design complexity with no additional fee assigned.

For a number of complexity factors, additional fees are allowed:

Traffic Studies .....0.4 to 0.2%  
Reconnaissance

Report .....0.4 to 0.1%  
Engineering

Design Report ....1.0 to 0.5%

Design Surveys .....0.7 to 0.3%

Boring Stakeout and

Inspection .....0.3 to 0.1%

As for supervision of construction, the manual states "the proposed fee . . . varies not only with the total project cost but also with the stakeout requirement."

Right-of-way surveys, land description, property record search, and right-of-way stakeout are ad-

## The Arithmetic of Materials Handling



Fuller Airveyor unloads wood flour to two forty-five foot silos. Second Airveyor system reclaims material 360 feet to processing.

### General Electric Changes From Bags to Airveyor ... Cuts Handling Costs 60%

As part of a program to increase plastics production and reduce operating costs at its Pittsfield, Mass. plant, General Electric Company called in Fuller engineers to design systems for handling wood flour in bulk.

Wood flour—used as a filler in phenolic molding compounds—was being handled in 75 and 100-pound bags. Unloading one carload of bags required 16 manhours. Bags were loaded on dollies and wheeled to a distant elevator.

**SAFETY FIRST**—The two pneumatic Airveyor® materials handling systems, engineered and manufactured by Fuller Company, were installed by its parent company, General American Transportation Corp., providing undivided responsibility. This installation resulted in a 60% saving in handling costs! The two systems

are handled by one full-time and one part-time operator. Manhours to unload one car have been reduced from sixteen to six!

In addition, all equipment is designed to conform to strict safety specifications set down by G-E engineers.

**FLOW YOUR MATERIALS**—The Airveyor is a system that flows your material through sealed pipes. It's fast, safe, and self-contained. The pipes can be placed close to ceilings, run underground or through walls.

Whether you process wood flour—or other dry granular materials—look into the many economies of Airveyor conveying. Write today for interesting, detailed literature on Airveyor and other Fuller pneumatic materials handling systems.



G-196  
1304

# Fuller

...pioneers in harnessing AIR

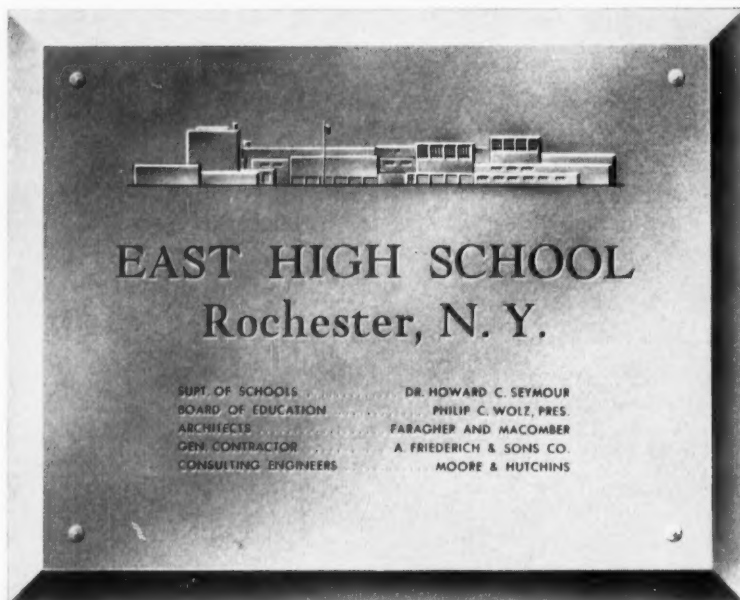
**FULLER COMPANY**  
118 Bridge St., Catasauqua, Pa.

SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION

Birmingham • Chicago • Kansas City • Los Angeles  
New York • San Francisco • Seattle

"See Chemical Engineering Catalog for details and specifications".

# STROMBERG-CARLSON congratulates...



East High School, Rochester, New York, scheduled for opening in September 1959, has been proclaimed the most modern and efficient in the country.

The architect and consulting engineer wisely specified a complete school communication system—and one of Stromberg-Carlson design met the specs completely. Here are a few of its functions:

- Instant playback of music group rehearsals
- Four separate program channels
- Emergency "red telephones" in selected locations
- Programming to any combination of rooms, set up from master console
- Intercom telephones in every room
- Emergency-call priority

Standard Stromberg-Carlson school systems components handled this job and can be "custom engineered" to meet your every need. Our field engineers are available for consultation on your current projects. Our factory-trained distributing organization is ready to handle all installation and maintenance problems. Why not see how we can serve you?

*"There is nothing finer than a Stromberg-Carlson"*

**STROMBERG-CARLSON**  
A DIVISION OF GENERAL DYNAMICS CORPORATION  
1440 N. GOODMAN STREET • ROCHESTER 3, N. Y.



ELECTRONIC AND COMMUNICATION PRODUCTS FOR HOME, INDUSTRY AND DEFENSE . . . INCLUDING HIGH FIDELITY CONSOLES; SCHOOL, SOUND, INTERCOM AND PUBLIC ADDRESS SYSTEMS

ditional items, and are to be paid for on a per-diem basis of twice payroll cost.

## "Selecting the Engineer"

Early in the new manual, considerable space is given to a discussion on how engineers should be selected.

"Numerous instances have been brought to the attention of the Society wherein clients have attempted to secure bids on a competitive basis for engineering services. Such a procedure is in violation of the Code of Ethics of ASCE. It is also in violation of the Code of Ethics of the Pan American Federation of Engineering Societies (UPADI). Such a procedure is also opposed by the American Institute of Consulting Engineers as indicated by a statement made by its Council on October 6, 1954," Manual 38 cautions.

In a discussion of "Selecting the Engineer," the manual explains that "the amount of the engineering fee is a minor consideration when compared to the total cost of the project. Any variation in fees that might be charged by well-qualified engineers is a still smaller factor in the over-all cost of a project. Sound engineering assures the client of maximum value per dollar expended. The total project cost, including engineering, is a definite reflection of the qualifications, professional experience, judgment, and integrity of the engineers performing the services. Any presumed saving in the fee for one firm as compared with that for another one less competent is almost certain to be exceeded many times over in additional costs of construction, operation, and maintenance.

"A professional engineer working for an inadequate fee can prepare plans and specifications in such a way as to save money for himself at the expense of the client, who, as a result, may pay greater costs for construction and extras. While such a practice is not necessarily a part of price competition, it is



**They compared  
efficiency,  
permanence,  
and applied cost  
...and bought  
ULTRALITE®**

FOR INFORMATION AND DELIVERY,  
CALL YOUR LOCAL ULTRALITE DISTRIBUTOR  
(LISTED IN THE YELLOW PAGES)

Compare . . . and you'll find that ULTRALITE is the only glass fiber duct insulation (and duct liner) made exclusively of long, strong, textile-type glass fibers. This means that ULTRALITE is stronger and more resilient than the rest . . . that it is more resistant to damage from vibration, air movement, and handling . . . that it offers more uniform thickness that results in full insulating efficiency and a neater job. Compare . . . and you will also find that ULTRALITE is outstanding in thermal efficiency and ease of application.

You pay not a penny more for ULTRALITE'S many advantages. You'll find it readily available in all major cities from local distributor stocks, plain or with a variety of factory-adhered facings that enhance appearance and prevent moisture condensation.

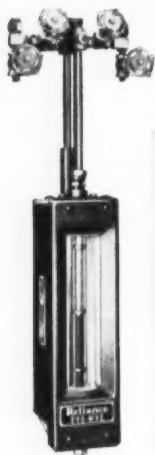
**GUSTIN-BACON** *Manufacturing Co.*   
212 W. 10th St., Kansas City, Mo.

Thermal and acoustical glass fiber insulations . . . molded glass fiber pipe insulation  
Plain and grooved end couplings and fittings

## For new plant or modernization

...you'll be wise to select...

**Reliance**  
water columns, gages  
and alarm devices.



Plan wisely for completely safe water level supervision on all boilers, and all water-containing vessels, with rugged, efficient Reliance equipment. This specialized line includes water columns for any type of boiler—any pressure—and complete trim, including various types of gage inserts, direct-to-drum assemblies and illumination; remote gages, auxiliary alarms and automatic controls.

Known the world over for accuracy, sturdiness and dependability, Reliance equipment brings you the advantages of trouble-free low-maintenance service. For keeping your plant in the best of trim now, or for planning new or revised power facilities, keep posted on the latest in Reliance Boiler Safety Devices.

The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, Ohio

*The name that introduced safety water columns....in 1884*

# Reliance®

**BOILER SAFETY DEVICES**

likely to result in lowering the quality and thoroughness of the engineer's services."

### Contract Provisions

The old manual had a short list of items that should be included in a contract—eight to be exact. The new manual includes 13 items, and goes into greater detail. Also included is a long list of services expected from the client, and also a list of the engineer's responsibilities relating to reports, plans, construction, and operation of completed projects.

### Engineering Reports

A discussion of engineering reports points out that the cost of making an engineering report varies considerably with the scope and type of the project, in addition to the use to which the report will be put. But it adds that "the rendering of reports or any other professional service on a contingent-fee basis is an unsound practice and is not in the best interests either of the client or of the engineering profession."

### Personal Services

In a listing of personal services, it is explained in both old and new manuals that "personal services usually involve specialized knowledge required in the solution of problems confronting the client that do not fall within the scope of a typical engineering design contract." However, the new manual goes one step further: "Such service is truly consulting engineering."

Two new bases for making charges for professional services are listed in the new manual—"salary cost times a factor plus incurred expenses" and "retainer fee plus per diem rates."

### Prequalification Procedures

The new manual ends with the two proposed forms of agreement and with a very brief "Guide Form for Prequalification of Engineers" (see Field Notes, December 1958). ▲▲

# SAVED!

by **KRAMER**

## THERMOBANK COMPRESSOR

**your money!** Kramer's THERMOBANK COMPRESSOR costs less — even less than most so-called "cheap" defrost systems. Many extra components are installed in this package unit, including compressor starter switch, evaporator motor switch, strainer, drier, high and low pressure switches, control box, magnetic starters, sight glass, purge valve, suction vibration eliminator and all service valves.

**your time!** Time saved is money saved. Factory assembled and run-in, THERMOBANK COMPRESSOR is ready to operate. It requires simplest connections between evaporator and compressor package, saving costly installation time. Start-up, control adjustments, and servicing are much easier. Expensive call-backs are eliminated.

**your space!** Uniquely designed, THERMOBANK COMPRESSOR is the only system where the high-side can be installed outdoors; it works in any location in the United States at any time of the year.

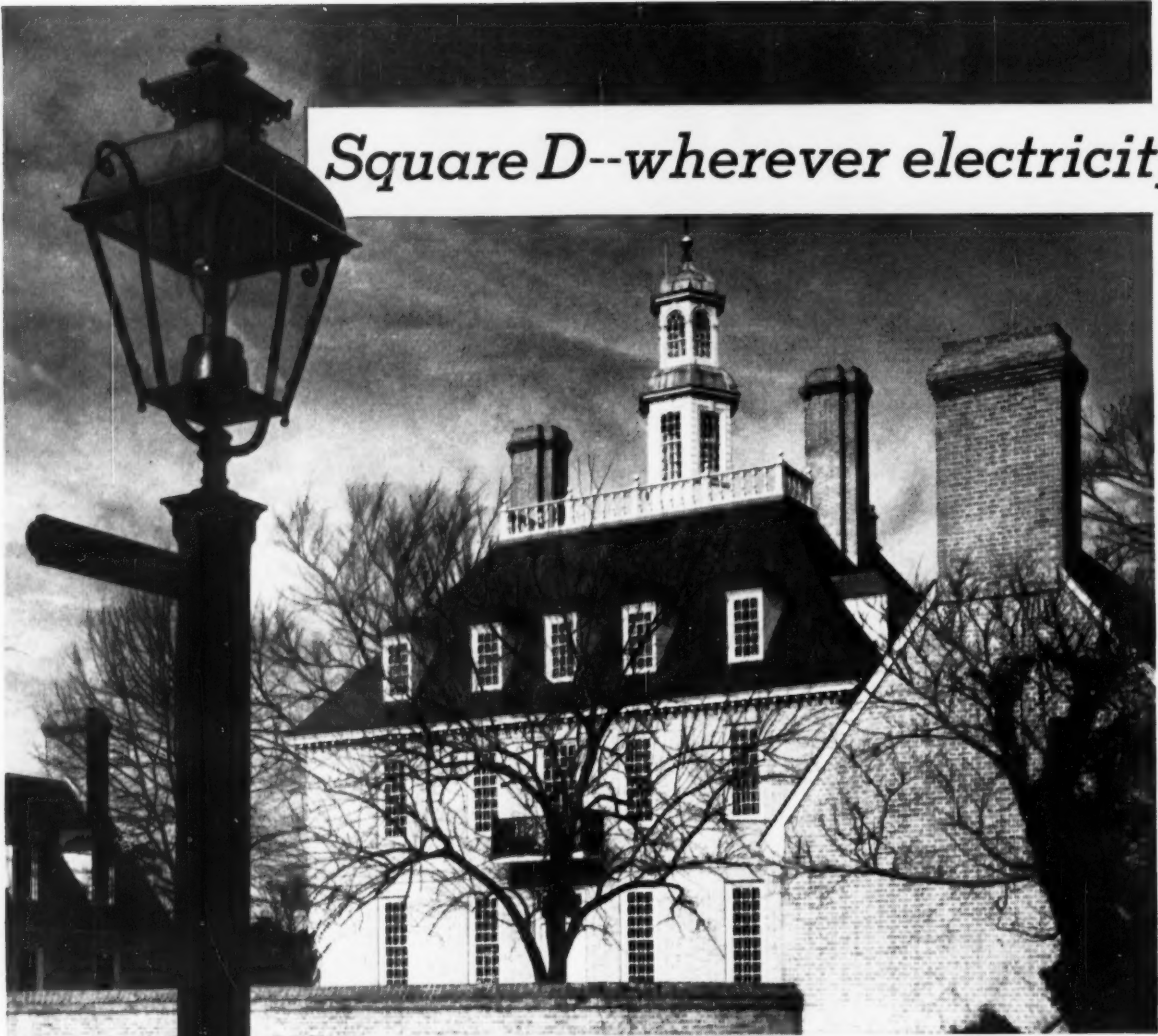


THERMOBANK COMPRESSOR FOR OUTDOOR USE

WRITE FOR BULLETIN TC-406

**KRAMER TRENTON CO. Trenton 5, N. J.**

45 YEARS OF CONTINUOUS ACHIEVEMENT IN HEAT TRANSFER



*Square D--wherever electricity*

**NOW IT'S AN EVEN GREATER EXPERIENCE  
TO VISIT**

**COLONIAL** *Williamsburg*

MORE THAN eight million people have visited this enchanting Virginia spot where the course of early American history was charted. Now, through the facilities of Colonial Williamsburg's new Information Center (*opposite page*), guests are provided with every conceivable

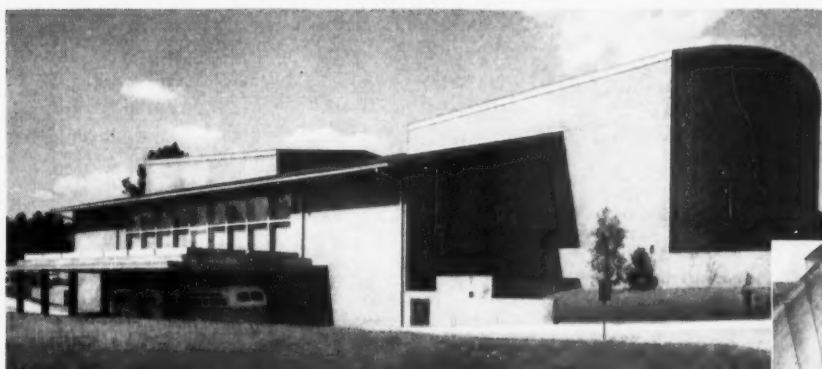
convenience and comfort to further enhance their stay. • Among the Square D equipment used throughout these new buildings—safety switches, motor starters, limit switches, relays, pushbuttons, control centers, switchboards, panelboards, duct and unit sub-stations.



**SQUARE D COMPANY**

*is distributed and controlled...*

**SQUARE D ELECTRICAL EQUIPMENT THROUGHOUT  
THIS BEAUTIFUL, FUNCTIONAL INFORMATION CENTER!**



For perfect viewing, theatre seat rows are four feet wide and rise on sharp one-foot elevations. Three-foot barriers between rows provide full visibility, unbroken by persons in front.

**Information Center**, through exhibits, maps, and personal direction, "conditions" visitors for their tour of Colonial Williamsburg. Twin theatres with world's largest indoor screens, offer continuous showings of "Williamsburg...The Story of a Patriot." Free bus service between the Center and the restored area. Parking for 1000 cars. *Square D* equipment in this area ranges from pushbuttons and relays to panelboards, bus duct and matched switchboard-control center.



**Motor House**, located on 12-acre wooded plot, provides 200 air-conditioned rooms. Lounge, recreation rooms and three swimming pools for guests' enjoyment. *Square D* loadcenters, panelboards and unit substation serve this motor house area.



**Cafeteria Building**, adjacent to Motor House and Information Center, serves 600 guests per hour. Spacious lounge. Gift shop. Air-conditioned. *Square D* equipment distributes and controls electricity for kitchen equipment, refrigeration, air-conditioning, and lighting.

**Field Engineering Service** is available through more than one hundred *Square D* offices, backed by an international network of over 1000 authorized electrical distributors and 17 plants in the United States, Canada, Mexico and England

Executive Offices • 6060 Rivard Street, Detroit 11, Michigan



One of *Square D*'s matched switchboard-control center installations. This one, in the cafeteria basement, feeds the entire building, serving lighting, air-conditioning, heating and boiler equipment.



# Beyond Our Borders

## Fee Schedules in Sweden

The Swedish Association of Consulting Engineers, founded in 1910, now has 141 members heading consulting engineering firms. Member firms employ about 1450 people, with the two largest firms accounting for about half of this total. Although their work generally is confined to Sweden, some of the larger firms also engage in projects in other countries in Europe and overseas.

Among the Association's recent accomplishments is the revision, in collaboration with the Swedish Association of Engineers and Architects, of the fee schedule for consulting engineering and architectural work. Since the Association of Engineers and Architects includes in its membership practically all engineers—those in state, municipal, and private employ as well as those in private practice—the rules are felt to represent all interests, including the client's.

The revised rules recommend the calculation of fees on a time-salary basis. The total fee is based on salary plus compulsory pension dues (somewhat the equivalent of Social Security taxes) on the project, with an addition of 75 to 100 percent for overhead and 10 to 20 percent for interest on invested capital and profit. For certain branches of the profession, the rules also contain scales of fees based on a percentage of project cost, but these are intended for estimating purposes only.

Although many members of the Swedish Association of Consulting Engineers have been working successfully for many years on a time-salary fee basis, the general adoption of the new rules has met with some difficulties—particularly in dealings with government clients. In Sweden, as in the United States, laws and regulations make it difficult for government bodies to enter into contracts,

even contracts for professional services, when there is no fixed price given. Government bodies are being cooperative, however, and the difficulty is being overcome by having the engineer provide a detailed explanation of charges and present his bills at frequent intervals. It also has been necessary in dealing with the government to modify some of the rules regarding arbitration, but now all parties are in general agreement.

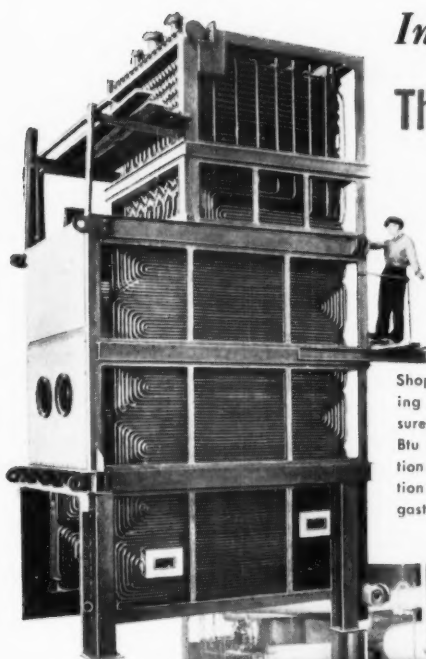
The government now seems to understand the Association's argument that it is impossible to define clearly the quality and scope of a consulting engineer's work before work is started. The Association also was successful in explaining the disadvantages of a fee based on a percentage of project costs, a fee arrangement that does not encourage the engineer to work toward the most economic solutions, for any reduction in project costs would reduce the engineer's own fee.

It is gratifying that architects as well as engineers are to use the time-salary fee schedule. This will eliminate the old argument over proper division of the fee between the two professions, for now each will be paid on the basis of his actual time-salary contribution. It also has been agreed that it makes no difference whether the architect or the engineer is the coordinator on the project—payment is still on a time-salary basis.

## Undersea Mining in Finland

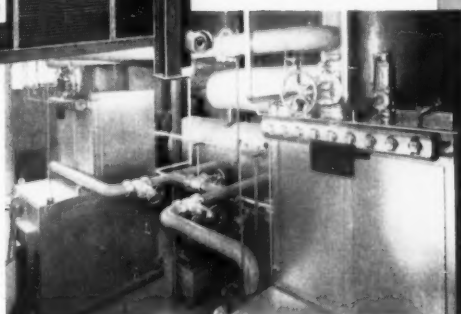
The Finns are mining iron ore from under the sea bottom some 15 miles off the mainland. These mineral deposits have been known for some time because of magnetic deflections noticed by passing ships, but only recently have they been commercially exploitable.

Because the phosphorus content of Finnish iron ore is as low as the best ores in Sweden, the new vein will be a valuable addition to the country's iron industry. The mine, some 1000 feet below the sea, will yield 30 million tons of ore with an iron content of about 50 percent. When mining is in full swing (summer 1959), 600,000 to 800,000 tons of ore are expected annually. Another nearby shaft should uncover 200-300 million tons of ore of a



Shop-assembly view showing steel frame and pressure parts for 25-million Btu unit prior to installation of refractory, insulation block, and welded gastight casing.

Compactness of C-E HCC Boilers is demonstrated in this view of two 10-million Btu units installed at a new Michigan high school.



The list at right points up the versatility and widespread acceptance of Combustion Engineering's HCC boiler. For industrials, schools, institutional use, military bases — wherever there is extensive space to be heated — C-E high temperature water has a place.

Featuring the same principle applied by Combustion in many of its large utility boilers, the C-E LaMont Controlled Circulation Hot Water Boiler offers a compact and effective arrangement of heating surfaces. This design gives precision temperature control, and, dependent upon local conditions, the HCC can save 10 to 20 per cent in maintenance and operating costs — a significant factor when considering a heat source.

Available in a wide capacity range — from 10 to 300-million Btu's — these boilers operate at water pressures up to 500 psi and temperatures to 470 F or higher. The smaller capacity HCC's are completely shop-assembled, while the intermediate and large units are shipped in varying stages of assembly. This C-E practice greatly reduces erection costs.

If you are in the market for boilers, either for space heating or process requirements, it may prove greatly to your advantage to investigate C-E high temperature water as your heat source.

Because individual needs vary, *both* steam and hot water have their applications. Combustion Engineering can furnish either, and our engineers are exceptionally qualified to discuss *impartially* with you or your consultants the method most suitable for your situation.

Write for further details on Combustion Engineering's High Temperature Water Boilers.

*In new plants large and small...*

**The C-E high temperature water boiler offers savings of 10 to 20%**

**Representative list of C-E HCC Boilers  
in service, under construction, or on order**

	No. of Units	Normal Output Btu/Hr. (millions)	How Fired
A. E. Smith High School Riverview, Michigan	2	10	Oil
J. Bishop & Co. Malvern, Pa.	1	12	Oil
Colorado State College Greeley, Colo.	1	60	Oil— Nat. Gas
Cross Company, The Frazer, Michigan	2	12	Nat. Gas— Oil—
Defense Construction Ltd. Camp Gagetown, N. B., Canada	3	70	Pulv. Coal Gas
Erie Mining Company Aurora, Minn.	2	65	Stokers— Oil or Gas
Convair Astronautics Div. General Dynamics Corp. San Diego, Calif.	2	30	Oil— Nat. Gas
General Motors Overseas Santos, Brazil	1	12	Oil
Hillcrest Medical Center Tulsa, Oklahoma	1	30	Nat. Gas
Marquardt Aircraft Co. Ogden, Utah	2	12	Oil— Nat. Gas
Michigan State University Oakland, Michigan	1	12	Oil— Nat. Gas
New Florida State Prison Raiford, Florida	2	30	Oil— Nat. Gas
North Carolina Wesleyan College Rocky Mount, N. C.	2	18	Oil— Nat. Gas
U. S. Air Force Academy Colorado Springs, Colorado	3	100	Oil— Nat. Gas
U. S. AIR FORCE: Clinton County Air Force Base Wilmington, Ohio	2	30	Nat. Gas
Dover Air Force Base Dover, Delaware	1	16	Stoker
Forbes Air Force Base Topeka, Kansas	3	50	Oil— (Fut. Coal)
Grand Forks Air Force Base Grand Forks, North Dakota	3	42	Oil— Nat. Gas (Fut. Coal)
McGuire Air Force Base Wrightstown, N. J.	2	25	Stokers— Oil
Minot Air Force Base Minot, North Dakota	4	50	Stokers
Plattsburgh Air Force Base Plattsburgh, N. Y.	2	25	Stokers— Oil
Portsmouth Air Force Base Portsmouth, N. H.	2	50	Oil
Wright-Patterson Air Force Base, Dayton, Ohio	2	110	Oil— Nat. Gas (Fut. Coal)
Wurtsmith Air Force Base Oscoda, Michigan	1	30	Stoker
Air Force Base Torejon, Spain	2	25	Stokers
U. S. Navy Auxiliary Air Station Fallon, Nevada	3	43	Oil
	2	15	Oil

## COMBUSTION ENGINEERING



Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT, NUCLEAR REACTORS, PAPER MILL EQUIPMENT, PULVERIZERS, FLASH DRYING SYSTEMS, PRESSURE VESSELS, SOIL PIPE

## DO YOU HAVE A FRIEND

### Who Is Qualified to Receive CONSULTING ENGINEER?

If you have a friend — or know someone in your own organization — qualified to receive CONSULTING ENGINEER free — but not now receiving it, send us his name.

#### QUALIFICATIONS ARE:

1. He must be with a consulting engineering firm engaged in private practice.
2. He must be a registered engineer.
3. His duties include responsibility for or influence over specification of equipment and materials.

#### FILL IN FRIEND'S NAME AND MAIL . . .

CONSULTING ENGINEER 217 Wayne St., St. Joseph, Mich.

Name

Company

Title in Company

Company street address

City

State

# MISTKOP

STOPS MIST

COLLECTS MIST-FOG EFFECTIVELY  
IN A SMALLER SPACE

NON-ELECTRONIC

This efficient Mistkop unit provides low-cost mist control for all machining operations employing coolants or lubricants. Requires no duct work or costly piping—is actually portable!

Mistkop is sturdy in design—has a minimum number of parts and gives long, trouble-free service. Stops clouding of lights... eliminates fire hazards of uncontrolled mist. Write for detailed description.

**AGET** Manufacturing Company  
1378 Church Street • Adrian, Michigan



25-35 percent iron content. At full capacity 2 million tons of raw ore may be obtained yearly from this second mine.

#### Steel Construction Economies

Saving steel is an important factor influencing German construction today. In Germany a ton of steel costs as much as 250 hours of construction labor, compared with 50 hours in the U.S. German builders, therefore, are willing to substitute many hours of labor to save a few tons of steel.

The difference becomes striking in multistory construction. A U.S. building will be designed with the same basic structural members through as many stories as possible to save on the cost of erection, but in Germany consulting engineers compute the actual building stresses story by story, and graduate the frame incrementally to save steel. There also is wide application of steel-reinforced and prestressed concrete.

An example of the emphasis on steel saving is the suspension bridge across the Rhine at Cologne. The earlier bridge, completed in 1929 and destroyed during World War II, took 12,900 tons of steel, but the new bridge, with the same dimensions and suspension system, used only 5800 tons, a 55 percent saving.

The increase of statics computations is a big postwar change in German construction. In bridge-building, there is now one engineer engaged in design calculations for every three in construction work, whereas the prewar proportion had been one for five. The Cologne bridge took 1200 pages of statics for its reconstruction in 1951; a new Cologne bridge under construction, spanning the same length and carrying the same amount of traffic took 4000 pages of statics. This increase in blueprints is compensated by savings in steel.

This emphasis on design has brought about marked changes in structural configurations. New bridge components include:

† An orthotropic plate, a flat steel plate reinforced by trusses welded lengthwise and crosswise. This reduces height of supporting tiers by 40 percent and makes it possible to use a 2-in. layer of asphalt as road surfacing over the plate.

† A box like structure, rigid against torsion, makes possible bridges of wide span and low height.

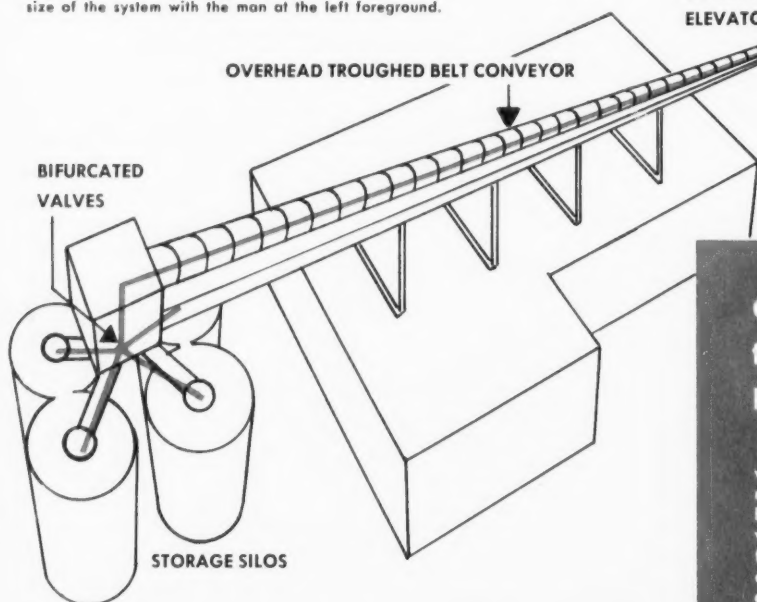
† A combination of steel tiers and prestressed concrete plates has been used in jointless lengths up to 1800 feet.

In addition to riveting and welding, bolt and screw connections have become favorites in German steel construction. Use of resinous glues for joining steel components is still in an experimental stage. One of the I. G. Farben plants is developing a complete line of such glues, and experimental



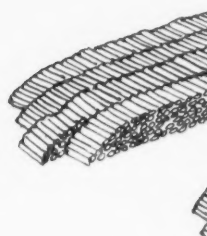


The covered belt conveyor extends 343 feet from the chipper house to chip storage silos. Compare tremendous size of the system with the man at the left foreground.



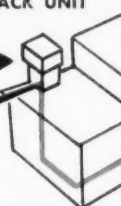
The unique fall out stations, lower left and right, prevent jamming by dropping excess logs off the main-line conveyor to be recirculated later.

TROUGHED SINGLE  
STRAND CHAIN CONVEYOR



POWERED SPIKE-ROLLER CO  
AND HOLDBACK UNIT

BUCKET  
ELEVATOR



CHIPPER

## Only 5 Op for 1,300 Bulk Hand

This log handling system was built and installed at a million dollar hardwood mill in Huron by Stone & Webster, which has eliminated jamming, makes it possible to store logs—ready for use—a distance of over 1,300 feet.

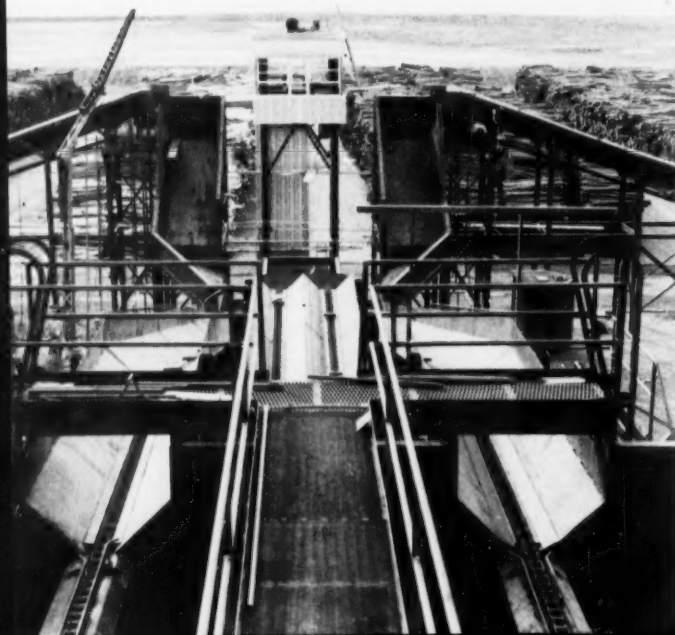
1. Actually, the system is double. It starts with two troughed strand chain conveyors carry the logs to the log wash, fall out stations, and then to the chipper.

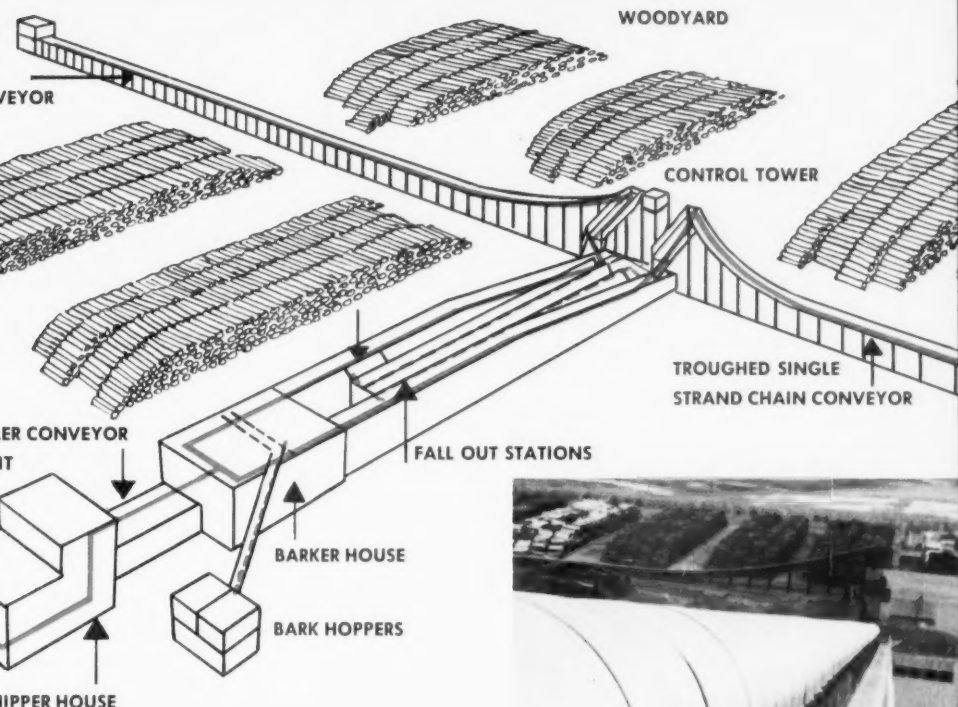
2. A unique feed system which prevent jamming by dropping excess logs off the main-line conveyor to be recirculated later. The system assuring an uninterrupted flow of logs to the chipper.

3. After the logs are chipped, they are carried by dual lines onto a powered bucket elevator to the chipper. This conveyor raises the chips from between the log wash and the chipper.

4. Following chipping, the chips are carried on a belt conveyor to a bucket elevator which carries them to the storage silos.

5. The chips are carried by means of bifurcated conveyors to rotary plows which deliver the chips per hour onto a system for delivery to the pulp mill.





View of the system from top of the chip storage silos looking down the side of the covered belt conveyor toward the woodyard. Lake Huron is in the background.

## Operators Required 80 Foot Planet Handling System

Handling, barking, chipping and storage system installed by Planet Corporation at a new multi-woodboard mill constructed on the shores of Lake Huron & Webster for Abitibi Corporation. The system, automated jamming through a unique fall out station, is capable for 50 cords of logs per hour to be chipped ready for pulp processing. The entire system covers over 1,300 feet and is operated by only five men. The system, from the woodyard to barkers, is conveying from opposite ends of the woodyard through single strand chain conveyors. These two conveyors feed the eight foot logs from the woodyard through fall out stations, inspection stations and barking

One feature of the system is the fall out stations which prevent jamming by automatically arranging the logs into single file. This is accomplished by dropping logs off the main-line conveyors into recirculating conveyors. These feed the dropped logs back into the main line at an uninterrupted flow to the barkers.

After logs have been debarked, they emerge from the barking house on a powered spike-roller conveyor to be carried to the chipper. This conveyor has a holdback unit that prevents logs from the chipper feed spout. The holdback unit, which is manually operated by an operator, prevents logs from the chipper feed spout.

During chipping, the chips are collected under the chipper conveyor. This conveyor transports them to a storage silo which lifts the chips to the roof of the chipper house. Here a long, covered troughed belt conveyor carries the chips to the storage silos.

Chips can be fed to any one of the four storage silos through curved valves. From the storage silos, the chips are carried by plate feeders at a rate of 2,500 cubic feet per hour to a system consisting of six belt conveyors for pulp processing operation.

### IT PAYS TO PLAN WITH PLANET

Here's an example of how Planet's engineering skill and know-how was put to use by one company. No matter what you make, it will pay you to have Planet Corporation on your team when you have a materials handling or automation problem to solve.

Planet Corporation is completely staffed with qualified and experienced graduate engineers. They will give your problem painstaking attention from preliminary surveys, engineering and design to installation and field testing.

Write or phone today to have a Planet sales engineer discuss with you the solution to your problem. There's no obligation, of course.

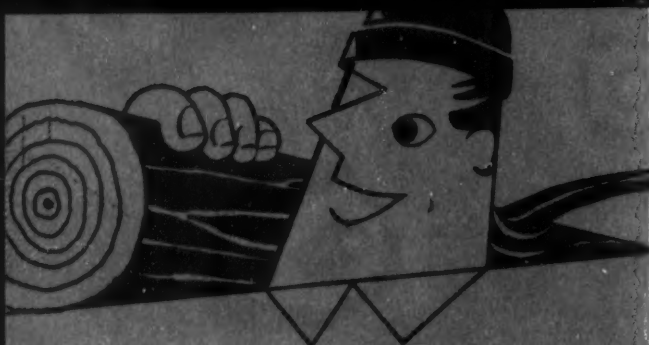
## PLANET CORPORATION



- ENGINEERED HANDLING SYSTEMS
- AUTOMATION EQUIPMENT
- FOUNDRY HANDLING EQUIPMENT

1823 SUNSET AVENUE

LANSING, MICHIGAN



## TO SOLVE ABITIBI'S BULK HANDLING PROBLEM, PLANET ENGINEERS OUTDID PAUL BUNYAN

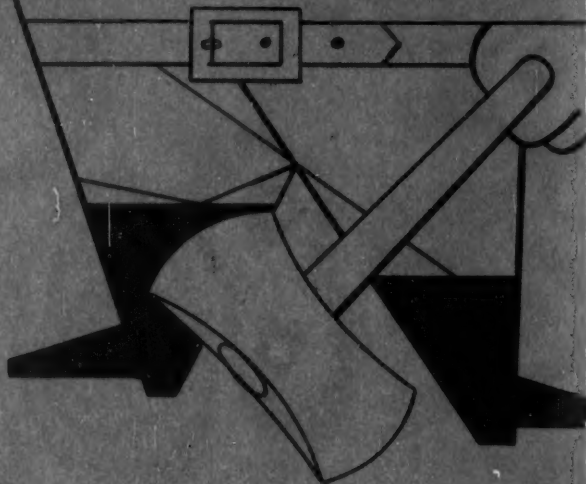
...gigantic system delivers 50  
cords of pulpwood per hour

Abitibi Corporation wanted a log conveying system. It had to deliver 50 cords of pulpwood per hour from woodyard through barkers, and chipper to chip storage piles . . . and the old bugaboo of jamming had to be eliminated!

Planet engineers combined systematic, logical procedure with creative engineering to bring Paul Bunyan . . . and his blue ox Babe . . . back to northern Michigan in the form of a gigantic bulk handling system. For the interesting details of the "Paul Bunyan" that was developed, look to the left and under this flap.

The Planet staff is well qualified to solve your materials (either bulk or unit) handling or automation problems. Its experience and know-how has been gained in creating complex engineered systems for many of the country's largest companies.

It paid Abitibi to "Plan With Planet" . . . it will pay your company too. Write or phone today.



# PLANET CORPORATION

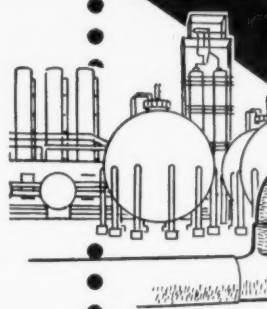


1823 SUNSET AVENUE

- ENGINEERED HANDLING SYSTEMS
- AUTOMATION EQUIPMENT
- FOUNDRY HANDLING EQUIPMENT

LANSING, MICHIGAN

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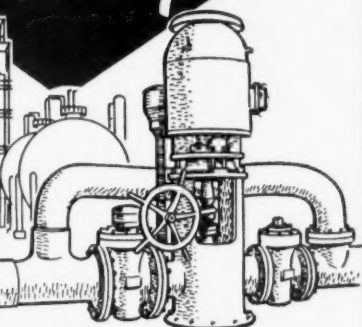
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applications on some smaller bridges within German industrial plants has proved successful. German engineers also are looking to new French spot-welding techniques for steel construction.

Another way of saving steel is to use high-grade steel, its higher price being more than compensated for by savings in steel tonnage. Weldability is the chief requirement of quality steels. Saving quantity by specifying quality also is applied to wire and cables.

As far as labor-saving is concerned, modern German practice aims at doing as much as possible in the workshop and as little as possible on the construction site, with large components shipped to the site for assembly. A recent example is the Friedensbrücke, a Frankfurt bridge across the Main river. A carrier grid 600-ft long was fabricated in the workshop and then placed on the support pylons by two floating cranes. Another example is the workshop construction of 65-ton carrier box units shipped to the site of another German bridge for assembly.

### Underground Lakes of Hot Water

The USSR Academy of Sciences is compiling maps of underground hot water resources of Russia. In western Siberia an "underground hot sea" covers over 1-million square miles. At a depth of 450 feet in the Moscow oblast there is "a veritable sea" of hot water at 170 F. In southern Russia, another large area of 210 to 300 F water has been discovered at a depth of 600 to 900 feet. The Hydro-Geological Laboratory at Makarenko believes there are lakes of hot water even under layers of permanently frozen ground.

Engineers believe that modern drilling methods will enable them to bring this hot water to the surface so it can be used for commercial purposes and district heating. Such installations would soon pay for themselves, for the reserves of heat are inexhaustible. In Kamchatka, the first experimental industrial power station operated by underground hot water is being built with a capacity of 400 kw. Utilization of heat from underground water for power generation is practical in Kamchatka, Sakhalin, Chukotka, and throughout the Far East. This is economically profitable, since in many of these areas fuel must be hauled great distances.

### Firth of Forth Bridge

A proposed highway bridge across the firth of Forth in Scotland will run near one of the first bridges in the world made of steel instead of cast iron. Designed by Fowler and Baker 80 years ago, the old railroad bridge was called "the supremest specimen of all ugliness." Completed in 1889, the bridge was made of cylindrical tubes, each built

CONSULTING ENGINEER

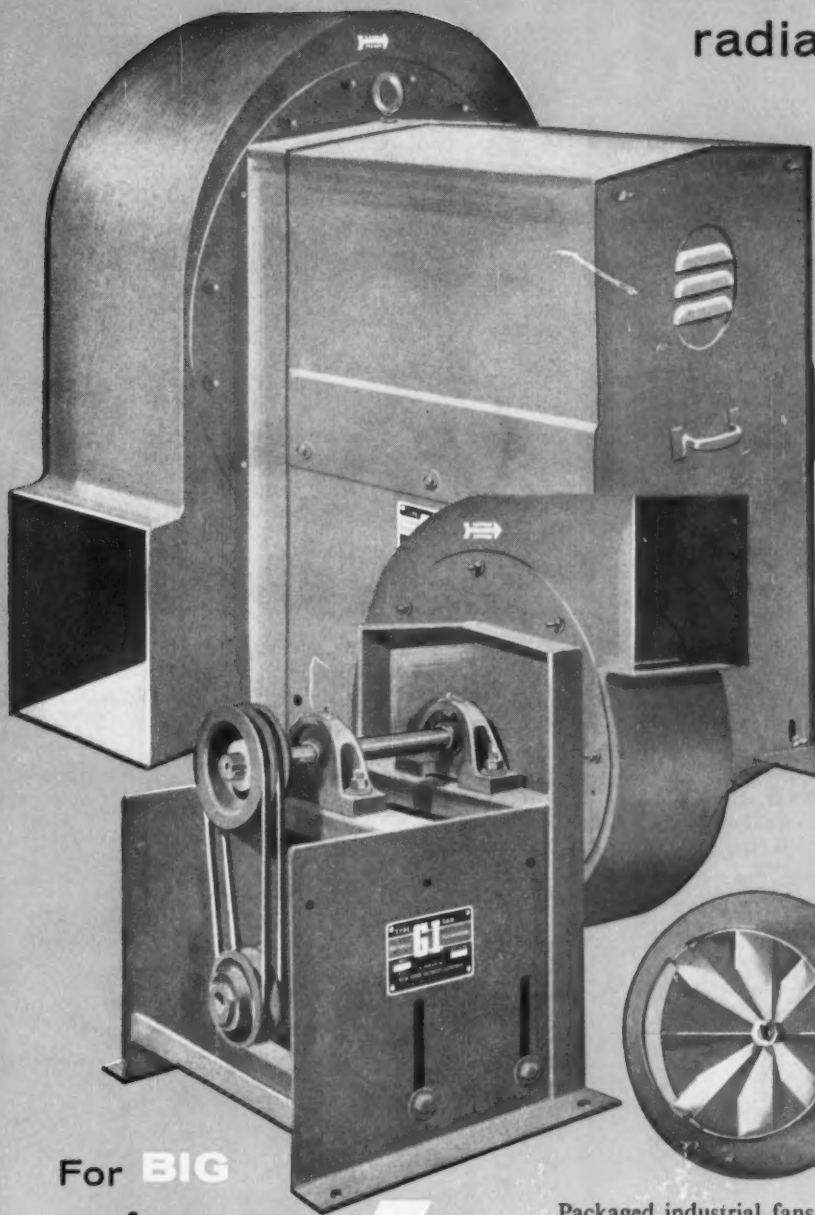


...economical G. I. type

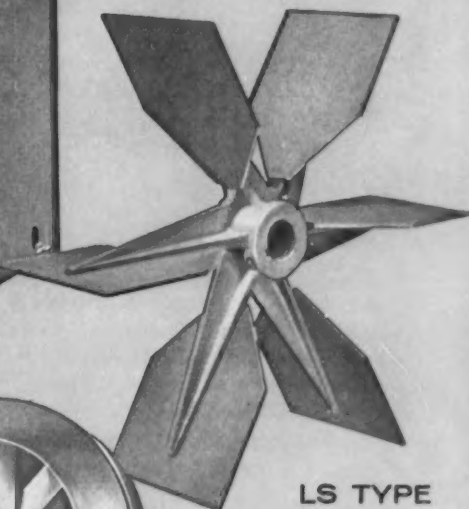
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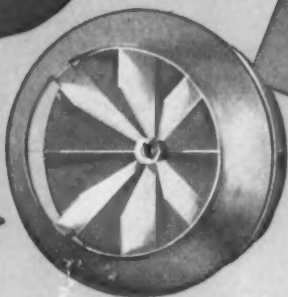
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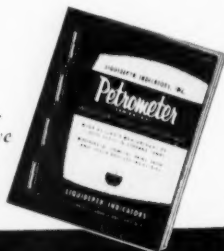
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For detailed information on Petrometer Indicators with the unique Aerator Valve write for Bulletin 6004 V.



up from individual curved pieces. Costing \$8.4 million, the bridge had two 1710-ft main spans.

With a central span of 330 feet, the new highway bridge will be the fourth largest suspension bridge in the world. Slated to be finished by 1963, the bridge will use 32,000 tons of steel (compared to 50,000 for the old bridge) and rest on reinforced concrete piers and viaducts. Consultants for the new bridge are Mott, Hay & Anderson, and Freeman, Fox & Partners.

*The Economist* (London) has dim views about the bridge's financing. Costs originally were estimated at \$16 million in 1947, with the British government paying in \$13 million. In the interim costs have jumped \$28 million to a \$44-million total, but it appears the government will still pay in only \$13 million; the balance is to come from tolls. This may work out all right, but *The Economist* notes that "no toll charges have been settled nor does there appear to have been any scientific survey or estimate of likely traffic."

### Russian Atomic Train

Soviet nuclear engineers are thinking of atomic powered trains, to run on 15-ft gage trunk lines crossing Russia from east to west. The present 5-ft gage is considered too narrow to permit use of much heavier freight cars, but if the track width were trebled and truck sizes also tripled, truck volume would be boosted 27 times, and the giant trains could run at 160 mph. Normal gage railways would connect with the new 15-ft gage trunk line at various points in the system.

Designers are considering a two-section locomotive consisting of a liquid-metal cooled reactor and an open-cycle gas turbine driven generator. An intermediate heat exchanger would transfer heat from the liquid-metal to the incoming air; and gas turbine exhaust would be nonradioactive. Both the reactor and heat exchanger would be shielded by layers of steel, lead, and special plastics.

The nine pairs of wheels of the proposed atomic locomotive, driven by nine 5000-hp electric motors, would take only half the output of the 60,000-kw generator. The rest of the power would drive electric motors under each freight car.

### Compressed Air for Ice-Free Harbors

Narrow Norwegian fjords reaching far inland make the use of regular icebreakers impossible for technical and economic reasons. A new method uses compressed air to remove ice; it is based on the fact that water near the bottom of the fjord is warmer and will melt ice already formed if it is raised towards the surface. A perforated plastic tube connected to a compressor is placed at the bottom of the channel. The hose is weighted to

## Question:

Why did Greater Cincinnati Airport use S&C Metalclad Switchgear in its high-voltage power system?

## Answer:

There was *only one* answer to the requirements of maximum reliability, continuity of service, adequate short circuit protection, and full load switching, all at low cost — S&C Fused Load Interrupter Metalclad Switchgear.

**Q:**

Why can S&C offer savings up to 50% in this modern switchgear and still meet the highest standards of quality?

**A:**

Because of the inherent simplicity of the S&C Fused Load Interrupter (compared to complex circuit breaker equipment), savings of 50% and more in the initial cost of switchgear equipment can be realized while the highest quality standards are maintained for the installation.

**Q:**

How can you get information about such switchgear?

**A:**

From S&C sales offices in principal cities. Consult your telephone directory.

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*Specialists in High-Voltage Circuit Interruption for Electric Utilities Since 1910.*

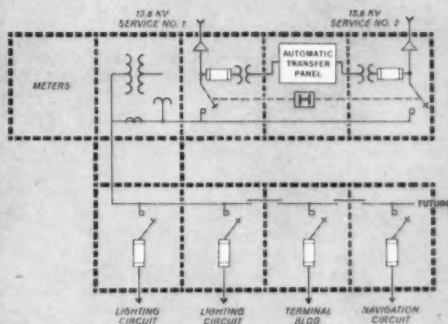


**Q:**

Why are power fuses and load interrupters used to replace circuit breakers in this type of switchgear?

**A:**

Because conductors in such installations as this modern airport run in protected underground conduit and tunnels, and are not subject to transient faults caused by trees, wind, or rodents; protection against permanent faults is the only kind needed—and this is provided by S&C Power Fuses.



**Q:**

How is automatic preferred-to-emergency transfer for service continuity provided in this S&C Metalclad Switchgear equipment?

**A:**

By means of an S&C Standard Automatic Transfer Panel used with Moto-Draulic operator, a variety of throwover schemes is available at the flip of a switch. This transfer panel provides for making either source preferred; choice of automatic or manual return; choice of time delay (up to 10 minutes); and optional manual operation of line switches.

## The Eagle Who Became A Pigeon



Once upon a time ...

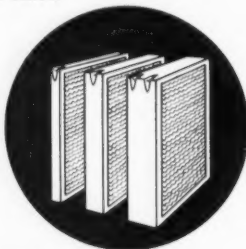
there was a high flying eagle who had a very humbling experience. The permanent panel air filters he had selected because of their bargain prices began to fall apart after only a few months of service. Realizing he had been taken for a pigeon, he let out a horrible scream.

Meanwhile, back at the aerie, his friendly Far-Air man was feathering Mr. Eagle's nest with samples of the "E Pluribus Unum" of permanent panels ... the Far-Air High Velocity Filter.

When he returned, his eagle eye fell upon the Far-Air Filters. He saw they were built to last and offered unexcelled performance. Ah, here at last were quality filters he could be proud to specify! He's been flying high ever since.

### Moral:

Compare before you specify! Swoop down on a beak-full of facts about Far-Air Filters. Send the coupon below homing to us.



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keep it immersed, and kept off the bottom so the holes cannot be clogged by mud.

In tests, the compressor was started up when a thick layer of ice had already formed. After 36 hours a free channel 12-yards wide was opened and steadily increased until it was 25-yards wide. The compressor was kept going during the day and shut off at night.

### Russian Highways

Arthur D. Margison, Toronto consulting engineer, recently toured Russia. Here are some of his observations on Russian roads:

¶ Russians are constructing bridges and culverts the year around and are building earthworks and foundation fill in quicksand or marshy areas. Experiments are being conducted on winter construction of concrete and asphalt pavements. Goal is winter construction for all kinds of highways.

¶ In many parts of Russia unavailability of suitable aggregates is a major problem.

¶ Prestressed concrete slabs 100 and 200 yards long are used on highways.

¶ Snow fences are widely used in regions of heavy snowfall and removed in the summer. Extensive tree plantings also protect highways from drifts.

¶ Russian engineers use aerial photography for establishing highway locations.

¶ Standard highway signs, almost identical with the international system, are used.

¶ Many urban streets in Moscow, other than main arteries, are either unpaved or inadequately paved.

¶ It is not possible to run a truck between Moscow and Ukrainian cities, particularly in late spring.

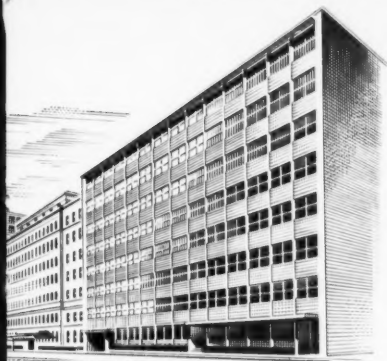
The largest trucks seen were for local bulk haulage and were comparable to our medium capacity trucks for earth haulage. No large tractor-trailer combinations were seen. There was no evidence of interurban buses; ones seen were for urban use.

### Water Resource Development in India

India's rivers drain an estimated 1.4 billion acre-feet of water. With this volume it seems a paradox that Indian agriculture is handicapped for want of irrigation. Yet such is the case.

Official statistics show some 316 million acres of land under cultivation, but only a sixth—51 million acres—have irrigation facilities. And of this sixth, just 47.5 million acres are cultivated. Five-year plans, therefore, have emphasized the development of extensive irrigation systems.

Of the many irrigation dams constructed so far, Bhakra-Nangal, Koyana, and Hirakud are of particular interest because of their engineering problems. At the Bhakra-Nangal site the Sutlej River passes through a narrow gorge. Flow velocity was so great it was impossible to construct a coffer-



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Today, Executone is an integral part of Mt. Sinai, serving the entire hospital. With 325 beds already served by Executone's Audio-Visual Nurse Call System, Mt. Sinai has applied other Executone intercom and sound systems to its many services and departments. Thousands of needless steps are saved daily at Mt. Sinai with Executone—clear, distinct two-way conversations take place at the touch of a button. The over-all result is more personalized patient care and improved administrative efficiency.

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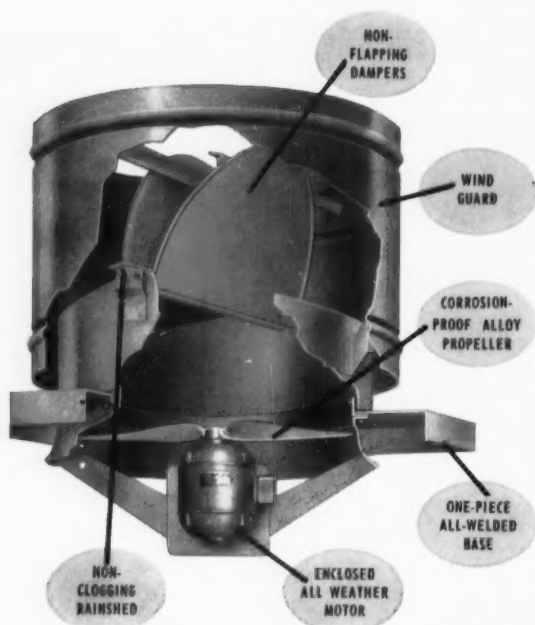
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





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dam. Instead, two diversion tunnels, 50 feet in diameter and a half-mile long, were bored through the mountain on either side of the gorge.

When the Nangal dam was built eight miles downstream from the main dam site, these diversion tunnels provided excellent water supply. They also fed irrigation canals, previously constructed, even before the reservoir filled up.

But there still were problems at the main dam site. Foundation excavations showed the bedrock was porous and sandy, incapable of carrying the Bhakra dam's immense weight. Deeper borings uncovered a solid basalt rock base, but the additional depth brought the total height to 740 feet, making it the second-highest dam in the world.

The Koyna project is of interest because steel, cement, and money shortages left the engineers no alternative but to construct everything underground except the 210-ft high dam itself. A tunnel carries water from the reservoir to an underground power house. Headrace and tailrace channels are tunnels. Cables run through tunnels. The only signs of power generation are the reservoir at one end and water gushing out at the other. The concrete-and-rubble construction saved on steel and cement and will save on maintenance, for the channels will need virtually no care.

The Hirakud project exhibits the best and worst of Indian engineering. The first phase, begun in 1948, took nine years to finish. The main dam, built of earth, masonry, and concrete, stretches 3 miles across the Mahanadi River. On both sides of the dam 22 miles of dikes and hills hold nearly 300 square miles of water backed up by the dam.

To build the dam, \$8-million worth of earthmoving machinery and related equipment was purchased. When these machines arrived, there were no trained operators to use them, no trained mechanics to service them. The costly equipment sat rusting while human labor and draft animals toiled to build the dam.

Other contemplated projects undoubtedly will involve new engineering accomplishments. One of these is an irrigation project under consideration by the Punjab Government. The plan is to construct a 3-mile tunnel through the Delhi Ridge to carry water from the Yamuna (Jumna) River to high-level farming regions in Punjab.

Since the tunnel will end near the Delhi water-pumping station, it also could carry water from tube-wells in Punjab to New Delhi where the Yamuna, present source of Delhi's water, is low in summer. This dual role is important because of the need to supplement the water supply for New Delhi's rapidly growing population.

The proposal to tunnel through the ridge was raised 12 years ago, but was turned down as too

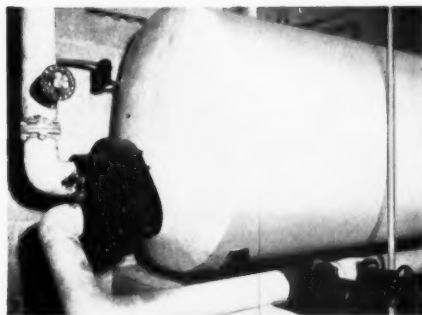
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From window glass to heating system, *quality* was the keynote at the beautiful new Galt Ocean Mile Hotel. This luxurious \$3,000,000 building is the first of 25 new hotels to be built on a one mile, \$19,000,000 stretch of beach inside the city limits at Fort Lauderdale, Florida.

Of course *delivery* and *price* were important factors, too. Two RECO Cement-lined Hot Water Storage Heaters (48" x 192" and 48" x 264") "more than adequately" met all three of these requirements according to William D. Cross, Mechanical Contractor.

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difficult. But since much bigger tunnels have been bored for dams under more difficult conditions, engineers believe the Delhi tunnel is feasible.

### Electricity Without a Generator

A boiler which produces electricity without a generator has been designed in the USSR. Current is generated by semiconductor thermoelectric batteries by the difference in temperature between the gases of combustion and boiling water. The batteries, about the size of a human hand, are an alloy of zinc, antimony, and other elements. They are heated by the gas on one side and cooled by boiling water on the other. The boiler will be used in areas without power such as remote farms. Current generated is sufficient to operate radios, lights, and charge car batteries.

### India to Expand Railroad System

India's railway system, oldest and biggest in the East, is undergoing a \$2.3-million modernization and expansion program to meet the rapid increase in freight and passenger traffic generated by planned industrial development.

Freight target for 1960-61 (end of the second five-year plan) is 180 million tons compared to 70 million tons moved in 1947-48, the first year of independence. For every million inhabitants India railways carried 4400 persons in the early 1940s; today this figure has more than doubled.

The railway expansion program gives work to 750,000 people—engineers, technicians, research, design, and standardization experts, and manual workers of all types. Construction projects—the greatest in the hundred-year history of the railways—include more than 6000 bridges, over 700 miles of new track, 1200 miles of double track, and remodeling of 50 major rail yards. Generating capacity of stations serving the railways will be boosted by 100,000 kw to feed 1450 miles of electrified track in the Calcutta region. Some 300 major stations will get interlocking signal systems, and a few of the biggest junctions, including Howrah (Calcutta), Delhi, and Kurla (Bombay City), will have route relay interlocks.

To meet the demand for more repair and maintenance facilities, six new workshops have been scheduled, 20 existing workshops will be expanded, and 34 new locomotive sheds will be built.

Designs of equipment and system components to better suit Indian conditions are provided by the Research, Design, and Standardization Organizations of the Indian Railway Board. The group has worked on high-capacity flat cars to move materials in bulk; welded-type rolling stock; improved pre-stressed concrete girders for railway bridges; and special expansion joints for welded rails. ▲▲

# Here's why it pays to Specify Silicone Insulated Transformers

## *A New Level of Performance for Power Station Auxiliaries*

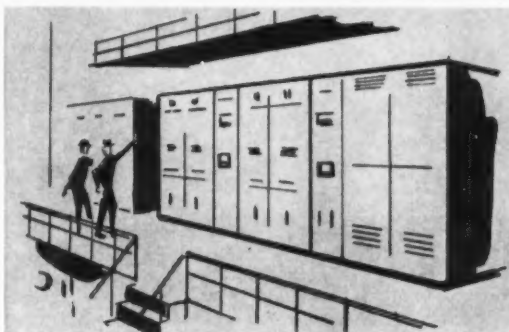
Insulated with silicones, dry-type transformers are so completely safe, you can locate them almost anywhere. Easier and less costly to install than liquid-filled types, they require no vaults, barriers or ventilating fans. And when installed, they offer the best assurance of uninterrupted power because Dow Corning Silicones mean extra overload capacity . . . superior resistance to high ambients, moisture and contaminated atmospheres. Here's how to select the dry-type transformer most suited to your needs —

*for maximum reliability,  
minimum maintenance* ➡

Specify a silicone-insulated *sealed* dry-type transformer. With core and coils sealed in an atmosphere of nitrogen, these units have no liquids to maintain . . . require only a periodic check of pressure gauge and bushings . . . are virtually maintenance-free.

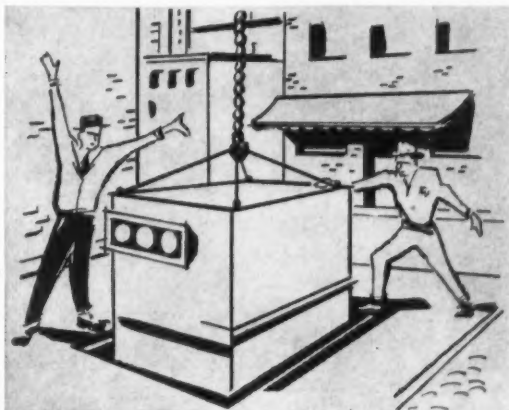
*for minimum weight* ➡

Specify a silicone-insulated *open* dry-type transformer. Lighter by 15% than the next lightest type, these units are ideal for balconies and other areas where minimum floor loading is a must.



## *A New Level of Performance for Underground Distribution Systems*

Silicone-insulated, nitrogen-filled *network* transformers require so little upkeep, they can be buried and virtually forgotten. They are undamaged even when flooded. Only the bushings, pressure gauge and case require periodic inspection. Dry-type transformers fit easily into existing vaults; are completely safe even in case of extreme overloads or short circuits.



*Send today for your copy of new brochure detailing how you can save with silicone insulated dry-type transformers. Includes up-to-date list of manufacturers offering equipment insulated with Dow Corning Silicones.*

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silicones

**Dow Corning CORPORATION**  
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS DETROIT LOS ANGELES NEW YORK WASHINGTON, D. C.

The new lift span on the Celilo Bridge over the Columbia River is being raised to permit river passage. Westinghouse supplied all the major elements of the electrical system, which can raise the span to 75 feet above mean high water in 90 seconds.



Sid Brown, Westinghouse sales representative, at right, is shown discussing approval of electrical control system with Mr. Don Thomas, assistant engineer of structures for Spokane, Portland and Seattle Railway; Mr. Glen Emory and Mr. Ed Bohm, partners of Emory and Bohm, electrical contractors.



# Celilo Railway Lift Bridge uses new Westinghouse static skew control

When construction of the Dalles Dam caused the Columbia River to rise closer to the deck of the Oregon Trunk Railway's Celilo Bridge, it became necessary to build a lift span to let river traffic pass beneath. A Westinghouse d-c adjustable-voltage drive, incorporating static skew control, was installed to provide smooth acceleration and a precise regulating system to keep the span level.

Set between two towers, the span is counter-weighted and suspended by wire ropes passing over sheaves at the top of each tower. Two Westinghouse d-c mill motors in each tower drive the sheaves and are electrically synchronized by the d-c adjustable-voltage system to keep the span level when operating. The various operations are so interlocked that they must follow a predetermined sequence to assure maximum equipment and personnel safety. The skew control equipment has safeguards against abnormal conditions and requires minimum maintenance.

Westinghouse equipment used on the Celilo Bridge includes: the main d-c drive motors, brakes, motor-generator, control regulating exciters, control board, an operator's console, emer-

gency drive a-c gearmotors and a 225-kva outdoor power center.

Westinghouse, as sole supplier of the coordinated electrical system, assumed undivided responsibility for its overall operation. For further information showing how this complete, single-source supply can benefit you, contact your Westinghouse electrical construction engineer, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94116

**Owner:** Oregon Trunk Railway (Operated by Spokane, Portland & Seattle Ry.)

**Consulting Engineers:** Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.

**General Contractor:** Kansas City Bridge Co., Kansas City, Mo.

**Steel Fabricators:** Pacific Car & Foundry Co., Seattle, Wash.

**Electrical Contractor:** Emory and Bohm, Portland, Oreg.

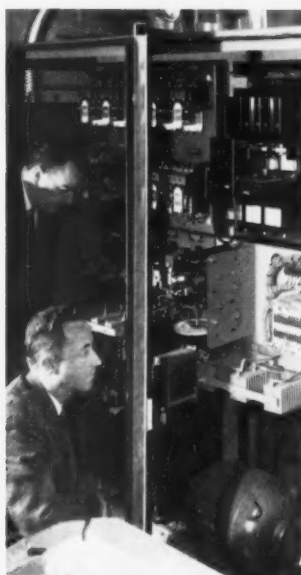
**Westinghouse Distributor:** Westinghouse Electric Supply Company, Portland, Oreg.

YOU CAN BE SURE...IF IT'S  
**Westinghouse**

**S** Over 250 Pages Westinghouse Data in Sweet's Construction File.



Chief operator, Champ King, at Westinghouse control desk. This desk centralizes the starting and stopping of railway traffic, selection of normal, auxiliary or emergency power supply, normal or emergency drive system and control of the lock and lift span.



Mr. Brown and Mr. Thomas inspect the interior of the main control cabinet which houses the Magamp\* regulator panel and Rototrol® elements of the bridge control system.

\*Trade-Mark



Mr. Bohm and Mr. Thomas examine the Westinghouse 33-hp Type MCA d-c mill motors, designed for heavy intermittent duty, which drive the main span machinery located at top of each tower.

# News for the Consultant

## Self-Discharging Super Collier

With its own automated conveyor system that can unload coal at the rate of one ton per second, the 635-ft collier Consolidation Coal ushers in a new concept in tidewater coal transportation.

Coal is carried in eight holds equipped with 150 hydraulically operated gates through which the coal flows by gravity to three 453-ft conveyors run-



*Mammoth ocean-going collier has been designed to deliver nearly 1.5 million tons of coal yearly.*

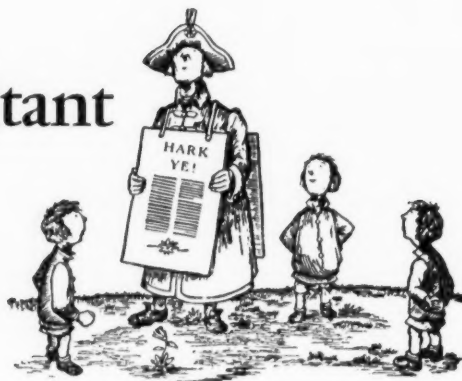
ning lengthwise through the ship. The conveyors discharge into hoppers in the bow where two elevators feed the coal to a 250-ft boom conveyor.

The boom can swing through a horizontal arc of 100 degrees on either side of the collier, and can be raised to pile coal 60-ft high. The boom can be aimed into a shoreside hopper or swept in arcs to stockpile coal in a ground storage area. Consolidation Coal, owned by the Pocahontas Steamship Company, carries a cargo of 24,000 tons.

## Rouge Plant Capacity Now 840 Mw

The third turbine-generator of Detroit Edison's River Rouge station, a 321-Mw unit, went on the line in October bringing capacity of the high-efficiency plant to 840 Mw.

Designed on the unit system of one boiler for one turbine-generator, two of the station's boilers produce 1,720,000 pounds of steam per hour, at 2000 psi and 1050 F. The number three boiler, feed-



ing the third turbine-generator unit, produces 2,100,000 pounds of steam per hour, at 2400 psi.

The first turbine-generator started generating electricity in February 1956; the second went on the line in November 1957.

## Mississippi River Pollution

The St. Louis Metropolitan Sewer District has retained the engineering firm of Horner and Shifrin for a 30-month, \$240,000 study to determine means to alleviate Mississippi River pollution in that area. The district also plans to look into ways of disposing of sewage treatment sludge, including how to convert it into fertilizer that could be sold.

## Jet Engine Overhaul and Test Facilities

Burns and Roe, Inc., New York consulting engineers, will design and supervise construction of jet engine overhaul and test facilities for Pan American World Airways at New York International Airport.

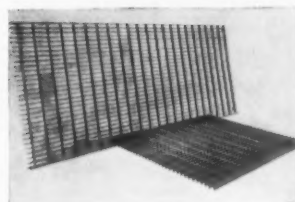
The modernistic curtain wall jet engine overhaul building, 160-ft wide and 330-ft long, will include welding and assembly and disassembly shops; offices and a lunchroom; and a small-parts storage area. The concrete structure test facility consisting initially of one test cell will have provisions for a second cell. Engines will be calibrated here following overhaul prior to their reinstallation in the aircraft.



*Pan American will overhaul, calibrate Pratt & Whitney JT-3 and JT-4 turbojet engines in new facilities.*



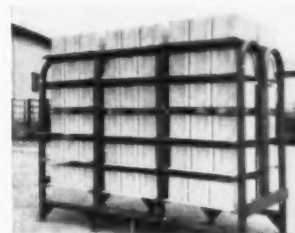
Fractured round illustrates the fibrous structure of 4-D Wrought Iron. These iron silicate fibers provide built-in resistance to corrosion and fatigue stresses. This unique characteristic is duplicated in no other metal.



GRATINGS



LADDER STEPS



BLOCK RACKS



STACK SUPPORTS

PITTSBURGH—"A full line of 4-D Wrought Iron bars, rounds and angles is now available from A. M. Byers Company. Bars are available in lengths up to 30 feet. Orders will be shipped within 2 to 7 days after receipt in Pittsburgh."—A. S. Chalfant, Vice President.

To meet the expanding market applications of our specifiers, Byers is now geared for quick service on 4-D Wrought Iron bars and shapes.

Our company has *always* manufactured Wrought Iron bars and shapes in limited sizes. But increased demand for 4-D Wrought Iron in commercial, industrial, and residential specifications has prompted us to supplement our line even more fully.

4-D Wrought Iron's resistance to corrosion and fatigue stresses keeps maintenance at rock bottom. No costly repairs. No premature failures. Thus, users of this versatile material can look forward to long life

installations at the lowest cost per year of service.

Availability of a full line of 4-D Wrought Iron bars, rounds and angles—with dependable, rapid-fire delivery—now enables specifiers to install complete jobs with this time-proven metal. Now, you need no longer use ferrous substitutes in such applications as: gratings, ladle stopper rods, mechanical shielding for nuclear reactors, manhole ladder steps, curing and process racks and bolts and brackets.

Ask the Byers representative for specific information. Or, write us for a prompt reply. A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.



## BYERS 4-D WROUGHT IRON

TUBULAR AND FLAT ROLLED PRODUCTS

ALSO AMBALLOY ELECTRIC FURNACE STEEL PRODUCTS AND PVC PIPE AND SHEET

**Corrosion costs you more than Wrought Iron**

The Burns and Roe Hempstead, Long Island office will handle the project, which is scheduled for completion in June 1959.

#### Florida State Fairgrounds

Gibbs & Hill, Inc., New York consulting engineering firm, has completed a preliminary study for new fairgrounds for the Florida State Fair on a 1½ by ¼-mile site near Tampa International Airport.

The proposed layout separates public access to attractions and access for services; and in the exhibition areas, all service entrances and parking are on street sides of building. The public promenade surrounds an hour-glass shaped 1800-ft long lagoon bridged at two points.

Four parking areas will accommodate 40,000 visitors daily. Year around attractions—including a coliseum, an auditorium and restaurant, the midway, a grandstand, and Tampa's Al Lopez Field—are conveniently located near parking lots. Total cost of the project is estimated at over \$20 million.

#### Society for the History of Technology

To study the development of technology and its impact on society, a new organization has been formed—the Society for the History of Technology. The group, with its members representing many different fields of study, is concerned not only with

the history of technological devices and processes, but also with the relations of technology to science, politics, social change, the arts and humanities, and economics. David B. Steinman, consulting engineer, is a member of the Executive Council.

Further information regarding membership in the society may be obtained by writing to the Chairman of the Executive Council, Professor Melvin Kranzberg, Room 315, Main Building, Case Institute of Technology, Cleveland 6, Ohio.

#### DMJM Shows Rapid Growth

Daniel, Mann, Johnson & Mendenhall, Los Angeles architect-engineering firm, may be the largest organization of its kind in the country in 1959, according to a recent survey. Founded as a three-man team in 1946 in Santa Maria, California, DMJM was in third place in 1957, with completed projects worth over \$150 million.

The firm's rapid growth has been attributed by partner Irvan F. Mendenhall to widespread diversification. DMJM plays an important part in the Defense Department's missile program, both in the United States and overseas; its special School Planning Division has served more than 41 southern California school districts, designing one-room school houses as well as complete college campuses; multistory office and apartment developments are another important facet of DMJM's business; and in public works, the firm has designed city halls and public buildings, has done more than \$30 million of flood control projects, and has been retained for several major sewerage projects.

#### Consulting Firm Credit Union

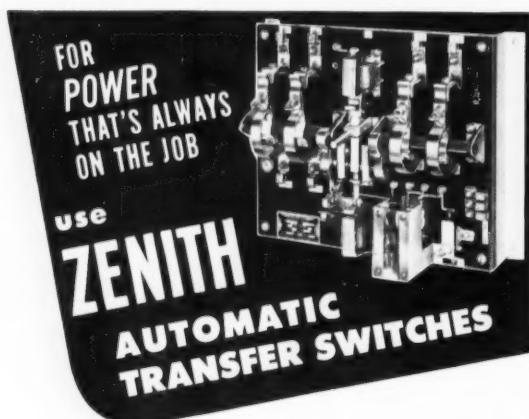
Employees of Burgess and Niple, Consulting Engineers, of Columbus, Ohio, have recently formed their own credit union, the fourteenth such organization in the country. A potential membership of 200 is expected, with both employees and their families eligible for membership.

#### Positive Temperature Coefficient Thermistors

Westinghouse Electric Corporation has developed a new switching thermistor exhibiting an abrupt and substantial increase in resistance at a specific elevated temperature. When the temperature falls below this critical point, thermistor resistance drops immediately to its nominal value.

Thus, these positive temperature coefficient solid-state devices become high resistance circuit elements at and above their design temperature—and perform in effect the function of a switch by opening the circuit.

It is possible to precontrol both the thermistor's residual resistance and the temperature level at which the switching occurs; units are available to



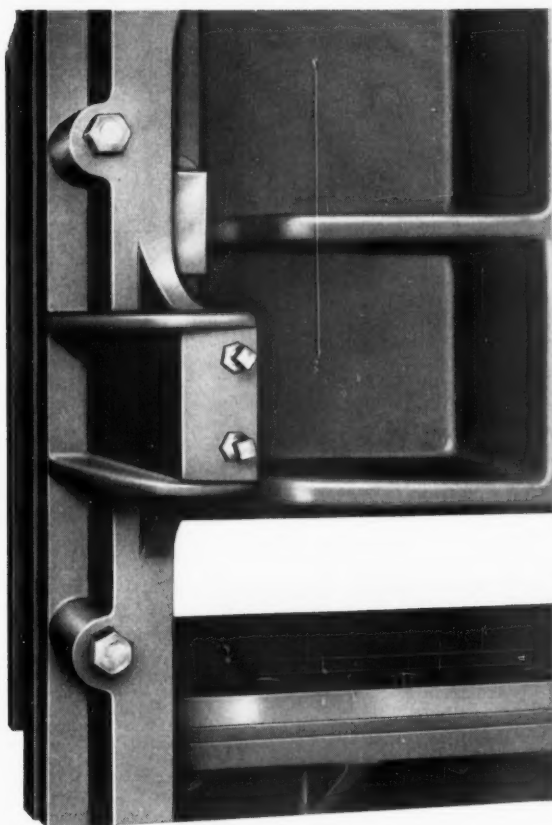
Zenith Automatic Transfer Switches assure full protection against any failure of regular voltage. Transfer to emergency power in a fraction of a second is automatic at 70% of line voltage. Regular power is restored at 90% of line voltage.

Simple design . . . sturdy construction . . . switches lock mechanically through trouble-free toggle action . . . no springs, latches or delicate mechanisms.

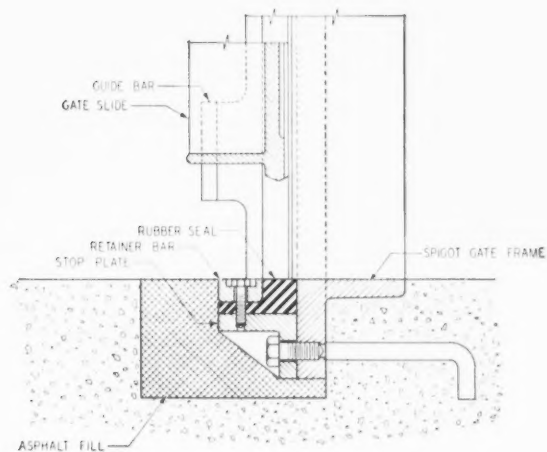
Available electrically or mechanically held, 30 to 400 amps.

Send for 64-page Engineering Reference Catalog E18-A.

**ZENITH ELECTRIC CO.**  
145 WEST WALTON STREET • CHICAGO 10, ILLINOIS



Close-up view of Armco Gate with flush bottom opening.



Detail of flush bottom opening.

*Gain Increased Capacity,  
Flushing Action,  
Uninterrupted Flow..*

## **SPECIFY ARMCO GATES WITH FLUSH BOTTOM OPENINGS**

Available in various Armco Gates, flush bottom openings provide a continuous flat bottom channel with no protrusions to interfere with flow or catch debris and solids. Since only the top surface of the rubber seal is exposed, these openings are equally efficient for flow or operating heads in either direction.

You can get the flush bottom opening on all sizes of Armco Series 35-05, 55-10, 55-20, and 100-30 Gates (more than 200 different gates).

Armco Gates are also available with standard perimeter seating. Sizes range from 6-inch square or circular openings up to similar dimensions of 108 inches. They may be provided for face heads up to 100 feet; back heads up to 30 feet.

For more information on these Armco Water Control Gates for municipal and industrial applications, just fill in and mail the coupon. Armco Drainage & Metal Products, Inc., 4419 Curtis Street, Middletown, Ohio. In Canada: write Guelph, Ontario.

**ARMCO DRAINAGE & METAL PRODUCTS, INC.**  
4419 Curtis Street, Middletown, Ohio

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## **ARMCO DRAINAGE & METAL PRODUCTS**



*Subsidiary of ARMCO STEEL CORPORATION*

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company  
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switch at specific temperatures between 200 F and 260 F, and will function in control circuits requiring a 17:1 ratio of maximum to residual resistance. Westinghouse installs these new thermistors directly in the windings of totally enclosed motors for over-temperature protection.

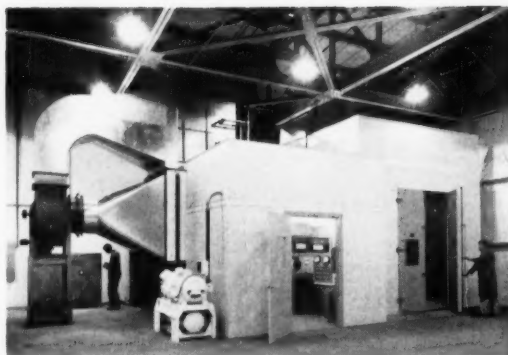
### Three Nuclear Reactor Concepts

Proposals by three architect-engineering firms for the performance of design and engineering studies of nuclear power reactor concepts have been selected by the Atomic Energy Commission following its evaluation of 86 proposals from 32 firms. Each of the firms will perform its study—to determine the design leading to the most economical nuclear power plant—in association with a subcontractor.

Stone and Webster Engineering Corporation, associated with Combustion Engineering, Inc., will make the pressurized water reactor study; Ebasco Services, Inc., associated with General Electric Co., will make the boiling water reactor study; and Bechtel Corporation, associated with Atomics International, will study the organic cooled reactor type.

### Engineering Center for National-U.S. Radiator

A new 40,000 sq ft engineering building in Johnstown, Pennsylvania will give National-U.S. Radiator Corporation needed flexibility to develop and



*This 25-ton sound and air conditioning test cell has been equipped with quick-disconnect couplings.*

evaluate new designs in heating and air conditioning equipment. The firm is exploring applications of heat pumps, and solar and electrical heating.

The \$1 million single story steel and masonry structure includes a 12,000 sq ft high bay laboratory area with an 18-ft ceiling to contain large test facilities. Initial installation of test equipment includes a 25-ton sound and air conditioning test cell equipped with a 40-ton condensing unit and air handling equipment capable of delivering 12,000 cfm. Two smaller cells and 23 boiler testing stations also are located in the high bay section.

All necessary services, including natural and bottled gas, city water, two grades of fuel oil, compressed air, single- and three-phase electrical power, and exhaust facilities are accessible at each of the test stations.

Heating and air conditioning requirements of the building are met by a system using a 2.5 million Btu per hour gas-fired water boiler and a 75 hp packaged industrial water chiller with water cooled condenser. A weather thermostat controls operation of the boiler and chiller, with thermostats in individual zones controlling operation of fan coil units in office areas. High-level illumination of 100 foot-candles was specified for the drafting rooms.

The building was designed by Hunter, Campbell and Rae of Altoona, Pennsylvania.

### Fire, Smoke, Combustible Vapor Detector

A small ultraviolet-sensitive tube has been perfected by Minneapolis-Honeywell Regulator Company, which can simultaneously detect fire, smoke, and combustible vapors. The new device, about three inches long and less than one inch in diameter, now makes possible the design of very compact fire and explosion warning systems.

In a typical warning system, the tube would work in an amplifier circuit to add up the impulses of



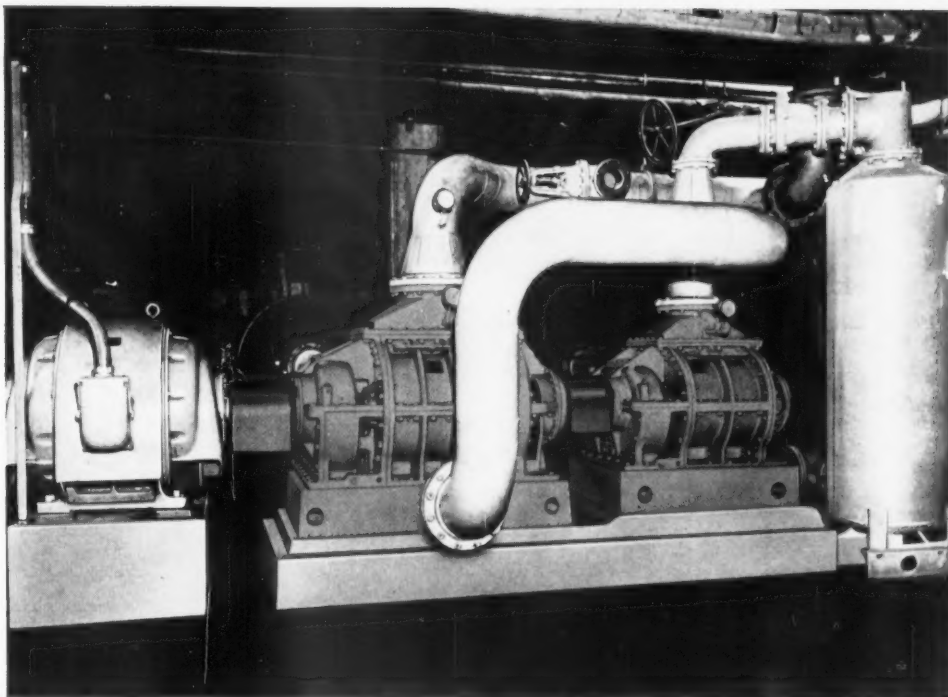
**CONTINENTAL**  
**FOR THE COMPLETE**  
**LINE OF**  
**INSULATED**  
**POWER CABLE**  
**VOLTAGES:**  
**600 TO 15,000**  
**SIZES: 14 AWG TO**  
**2,000,000 CM INCLUSIVE**

With a complete range of voltages and sizes, Continental Wire offers POWER CABLE in types V . . . AIA . . . AVA . . . AVB . . . SILICONE RUBBER . . . TEFLON TAPE . . . and VARNISHED GLASS TAPE for extremely high temperatures. For power cable with excellent current carrying capacities, resistance to oil, grease, corrosive vapors, moisture, as well as high temperatures—call CONTINENTAL, Wallingford.

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FOR CHEMICAL AND ORE PROCESSING



RCV-2 vacuum pump — 16x35 and 14x24 in compound arrangement, rated 7740 cfm at 22" Hg vacuum, operating at 900 RPM with 294 HP.

## NEW R-C compound vacuum pump arrangement simplifies installation

With a new "straight-through" drive design for compound vacuum pump applications, Roots-Connorsville has not only simplified piping arrangements but has also further reduced installation time and costs. This new development features a drive-through arrangement with the second stage pump driven directly from a shaft extension on the first stage pump. This permits the use of a standard single shaft extension motor drive. Other pump improvements provide for operation at higher speeds giving more CFM per dollar.

In addition to simplifying installation of the piping, this arrangement provides for easier servicing and maintenance of both pumps and motor. Installations of this new arrangement in chemical plants, uranium and tacomite processing plants and paper mills have completely substantiated its advantages in long, uninterrupted performance.

Here is another reason why you can depend on Roots-Connorsville equipment for vacuum service to deliver the finest overall performance and dependability at low cost... a reputation proved for generations in the country's leading industries.

For additional data, please refer to our section in **Chemical Engineering Catalog** or write for Bulletin VP-158



### ROOTS-CONNORSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

159 Wilson Ave., Connorsville, Indiana. In Canada — 629 Adelaide St., W., Toronto, Ont.



electrical energy generated by the tube as it measures ultraviolet intensity. The tube is insensitive to ultraviolet light given off by artificial lighting. The new device can be produced economically, and its designers claim an almost unlimited life.

#### Curtain Walls for Sound Attenuation

Recent studies indicate that metal curtain walls may prove to be more effective as sound barriers than originally thought. If used properly, they sometimes can attenuate sound better than a one-foot thick solid concrete wall.

It has been established that a metal curtain wall and cellular roof deck composite, of about three pounds of wall weight per square foot, can cut down sound transmission by 30 decibels.

Use of double-wall partitions is a particularly effective way of reducing noise. Future designs of offices and motels near airports could be designed as buildings-within-buildings, with double curtain walls and corridors around the outer perimeter, and staggered doors and windows.

#### El Camino District Hospital

The largest California district hospital to be built from the ground up, to cost \$7.3 million, will soon be under construction in Mountain View. Woodward, Clyde, Sherard & Associates, Oakland, are

the civil engineers; Smith and Moreland, San Francisco, are the structural engineers; Buonaccorsi and Murray, are the mechanical-electrical engineers; and the architects for the project are Stone, Mulloy, Marraccini and Patterson.

The main portion of the six-story structural steel frame building will contain 360 beds, with plans for a future nursing unit addition of 90 beds on a seventh floor. Exterior walls are of brick, masonry, and glass.

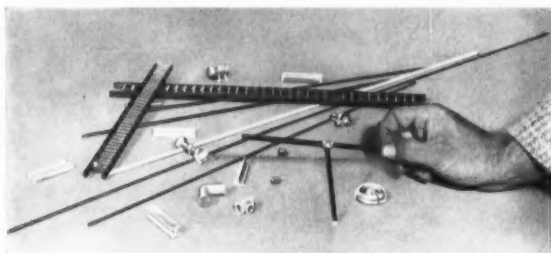
#### Union Dome

The world's largest dome—384 feet in diameter at its base and 120-ft high—and the first major industrial application of the geodesic principle of design



*Aerial view of all-steel Union Dome, big enough to enclose baseball diamond. The finger at top of the photograph is the tank car painting tunnel.*

### NEW! YOU CAN BUILD Accurate Scale Models



Quickly, economically with

### "DESIGNING IN 3-D"

DO-IT-YOURSELF three-dimensional drafting

For years consulting engineers have used scale models to sell plans and solve problems in design. Many smaller jobs, however, could not be executed in miniature because costs were prohibitive. Now your draftsmen and engineers can create accurate scale models of any job more economically than ever before. Whether your work is in product design, plant layout, architectural, topographical, mining — Scott Industries offers you one source of supply for thousands of parts. Scott Industries also offers you the services of the only national, localized custom model-making network.

*Write for full information on "Designing in 3-D" and catalog of parts and materials*

**SCOTT INDUSTRIES, INC.**  
Dept. CE 1, Olean, N. Y.

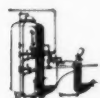
has cost its builder, the Union Tank Car Company, less than \$10 per square foot of floor area. The unique welded steel panel structure in Baton Rouge, Louisiana makes it possible to accomplish all railroad tank car repair under a single roof.

The Union Dome is approximately a one-quarter sphere, designed as a three dimensional curved truss four-feet deep. The truss consists of involuted  $\frac{1}{2}$ -in. sheet steel hexagon sections serving as both the weathering surface and the inner member tension system. The outer portion of the truss is composed of 9-ft long, 4-in. steel pipe compression members attached to the inner system with  $\frac{3}{4}$ -in. diameter tension rods. These elements lie along typical geodesic great circle grid lines with the sheet steel fold lines repeating the pipe-rod system geometry.

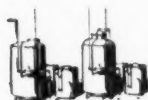
Erected without scaffolding, the structure was begun at the base with panels lifted by cranes and brought into edge contact for welding. The bill of materials for Union Dome consisted of only seven items: standard 11-gage sheet steel; 4-in. steel pipe;



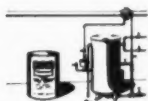
**ZEOLITE WATER SOFTENER** — manual and automatic. Up to 44% more soft water output from a softener of given size.



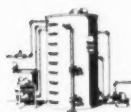
**ULTRA-DEIONIZERS** — produce highest quality mineral-free water. Replace distillation methods at fraction of distillation cost.



**DEALKALIZATION & ION EXCHANGE SYSTEMS**—Dealkalizers to control alkalinity. Ion Exchangers to produce water of any desired quality.



**CHEMICAL TREATMENT SYSTEMS**—prevent scale, corrosion and depositions with Elgin specially formulated chemicals.



**CLARIFIER**—for removing excess alkalinity and solids for clarification of turbid waters.



**DEGASITORS**—for removal of entrained gases from water by aeration.



Typical Elgin Automatic Deionizer

## WHO IS QUALIFIED To handle your water conditioning job?

Today's remarkable advances in water conditioning should suggest methods and equipment that can perform a profitable service for you . . . and this brings up the all-important question:

*Who is best qualified to get right down to the practical job of putting these advanced methods to work for you under your specific conditions?*

Certainly the best answers will be found in an organization like Elgin that knows and offers every modern

and authoritative approach to any water conditioning problem.

The scope of Elgin equipment and services is briefly touched upon here. To cover the full line would require many pages, but whatever your problem, Elgin with 50 years of intensive specialization is well qualified to solve it. No other organization is better equipped to determine your needs and meet them in the best and most economical way.

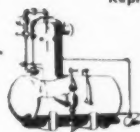
*Your nearest Elgin Representative would like to put our fifty years of experience to work for you. Or, if you prefer, tell us your conditions and we will send covering bulletins.*

### ELGIN SOFTENER CORPORATION

146 No. Grove Avenue, Elgin, Illinois

Representatives in Principal Cities

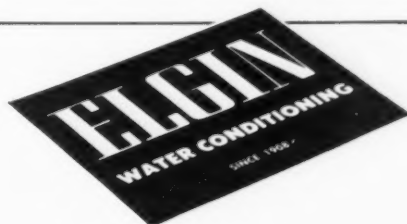
In Canada: G. F. Sterne & Sons Ltd., Brantford



**DEAERATING HEATERS**—supply make-up water pre-heated by exhaust steam in which CO<sub>2</sub> and oxygen are eliminated.



**WATER FILTERS**—Diatomite, sand, anthracite, activated carbon and oil removal filters in all types and sizes.



1½- and ¾-in. steel rods; 2-in. sleeves; 1½-in. nuts; and washers.

Inside the dome is another similar structure, 80-ft high and 100 feet in diameter, housing offices, materials storage, and including a central control tower overseeing all repair operations.

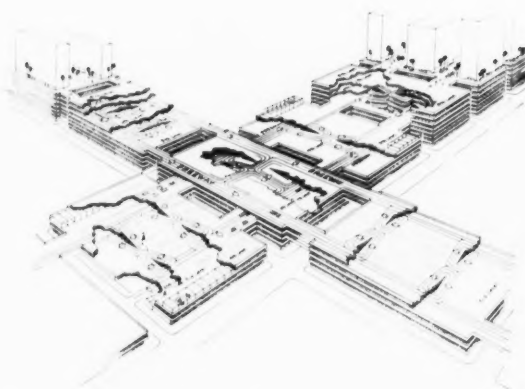
Bathey & Childs, engineering-architectural firm of Chicago, did the mechanical and electrical engineering and supervised construction. Design of the Dome itself was a joint effort between Union Tank Car engineers and Synergetics, Inc. of Raleigh, North Carolina.

### British Ethylene Plant

Stone & Webster Engineering, Ltd. (London) will design and construct Europe's largest ethylene plant in Grangemouth, Scotland for British Hydrocarbon Chemicals, Ltd. The new plant, scheduled for completion by the middle of 1960, will more than double capacity of the firm's existing facilities for production of olefins.

### Urban Development

E. M. Khoury & Associates, Canoga Park, California consulting engineers, have an urban development plan that will enable the motorist to take his automobile into the heart of a downtown area and park within a block or two of his ultimate destina-



Schematic shows typical intersecting blocks of new urban plan. Note desk-side warped deck parking areas.

tion, without encountering a traffic light enroute.

The singular feature of this scheme is a system of elevated roadways incorporated in the downtown area, entirely independent of existing streets. This traffic system would link with present intra-urban expressways. Warped deck garages (CONSULTING ENGINEER, January 1958) will be built in the interior of new office buildings, and elevated pedestrian walks, parks, and shopping facilities will tie in with existing structures.

### Michigan-Ontario Highway Bridge

D. B. Steinman has submitted an engineering report to the Michigan Highway Commission estimating costs for a proposed highway crossing of the Soo Locks from Sault Ste. Marie, Michigan to Sault Ste. Marie, Ontario. A tunnel connecting the two cities would cost \$27.5 million, while a bridge was figured at \$18.2 million. The cities now are connected by Canadian ferry service across the St. Marys River.

Plans call for construction of the center section of the bridge with revenue bond financing by the International Bridge Authority. Michigan would be eligible for 90 percent Federal aid as part of the interstate system for its American section, estimated to cost \$5.2 million. The consultant says the bridge could be built in 20 months.

### Enrico Fermi Atomic Power Plant

Construction of Michigan's first electric generating nuclear station, the Enrico Fermi Atomic Power Plant, 35 miles southwest of Detroit on Lake Erie, is on schedule.

The nuclear portion of the plant—reactor, heat exchangers, and auxiliary equipment—is being built and will be owned and operated by Power Reactor Development Company, a nonprofit group repre-

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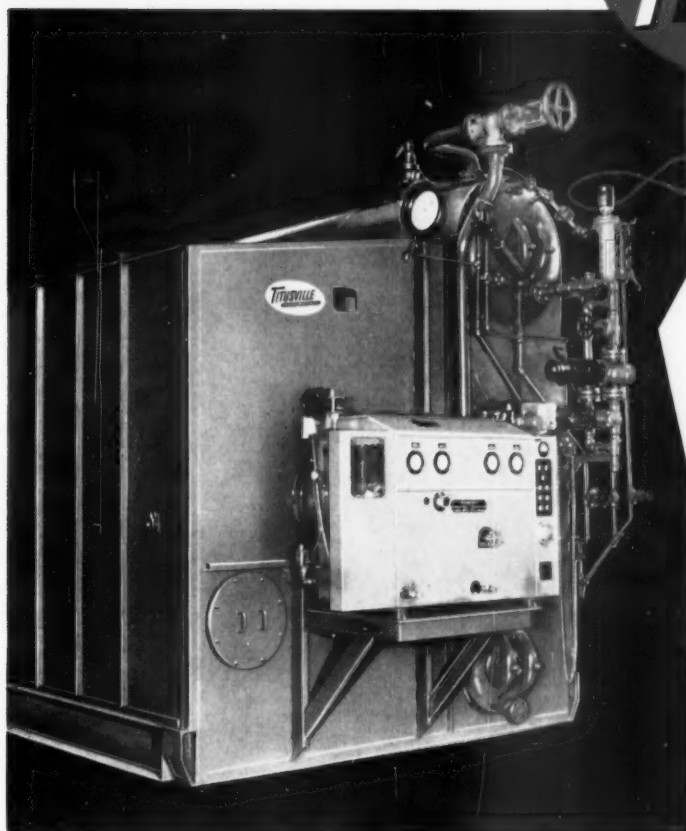
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Shafting . . . Straightening and Back-up Rolls



Enrico Fermi power plant site: 1—reactor containment building, 2—equipment entry chamber (temporary), 3—sodium tunnel, 4—sodium storage and purification building, 5—plant offices and control center, 6—boiler house foundation, 7—water treatment plant, 8—turbine house location, 9—water storage tank, 10—construction offices, 11—information center, 12—meteorological tower, 13—lagoons and marshlands, 14—the shore line of Lake Erie.

senting 21 electric power and industrial companies. Research, basic design, and testing in connection with the project are responsibilities of another nonprofit group, Atomic Power Development Associates, Inc.

The reactor is a fast neutron breeder type oper-

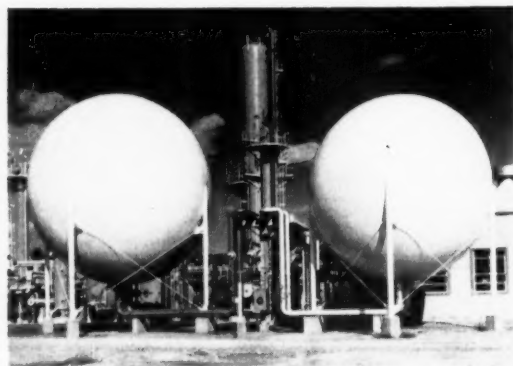
ating on a U-235 - Pu cycle. A uranium-molybdenum alloy core, enriched to about 27 percent with U-235, and the depleted uranium blanket are designed to produce an initial output of 300 Mw of heat. Heat is removed from the reactor core and blanket by the primary coolant sodium. This heat then is transferred to secondary coolant sodium, and finally to boiler feedwater and steam.

The 156-Mw turbine-generator station, supplied with 600 psia, 755 F steam to the turbine throttle, is being built and will be owned and operated by the Detroit Edison Company.

United Engineers & Constructors, Philadelphia, is engaged in general supervision of site development work and installation of service facilities. The firm will supervise erection of the turbine-generator and all other nonnuclear facilities.

#### High-Energy Fuel Refinery on Stream

Callery Chemical Company's new \$38 million refinery in Muskogee, Oklahoma, is the nation's first large-scale production facility for the processing



Low pressure gas storage units for nitrogen (left) and carbon dioxide. Tower separates two gases.

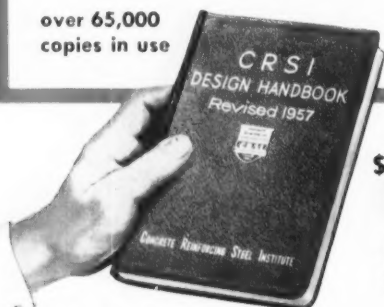
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CONCRETE REINFORCING STEEL INSTITUTE  
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of new high-energy liquid fuels for aircraft propulsion. The company's boron-based fuels, called Hi-Cal, are produced by processing boric acid to produce diborane. Further processing of the boron hydride, combining it with carbon and hydrogen, produces the powerful fuel.

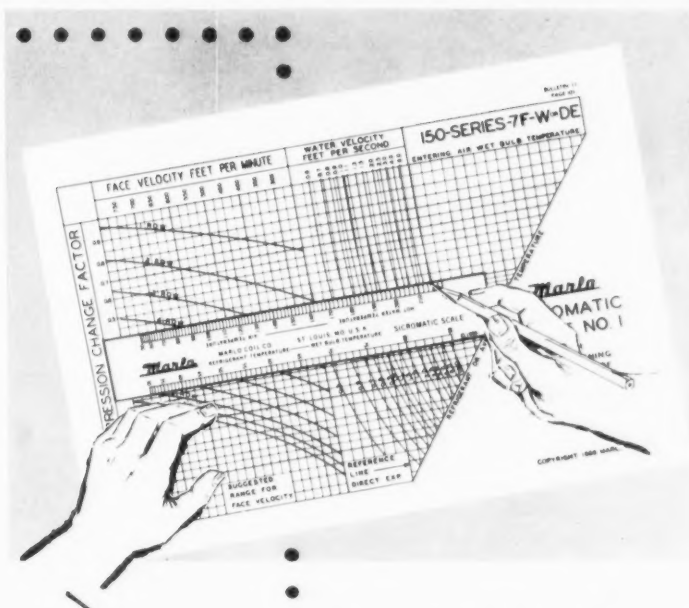
Because of the number of chemical reactions occurring at elevated temperatures, a steam plant was required that is nearly 25 times larger than the steam plant in a conventional petroleum refinery of comparable size. A \$3.5 million gas plant producing carbon dioxide and nitrogen from the controlled combustion of natural gases also was built to produce the large quantities of nitrogen needed as an inert blanketing gas. A liquid distillation column

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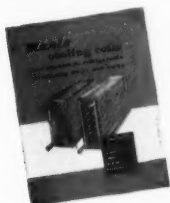
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permit direct graphical coil selection *in a matter of seconds*, with the simple location of two straight lines. On one chart, you can read all necessary data for a particular application, including proper refrigerant or chilled water temperatures.



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handling both solids and liquids was specially designed for the process.

Liquid waste is pumped into an 11 million gallon storage lake for treatment before discharge into the Arkansas River. Oils and other combustible liquid wastes are burned in waste incinerators.

The Ralph M. Parsons Co., Los Angeles, was coordinating architect-engineer for the project.

#### Highway Bridge, Machine Design Contests

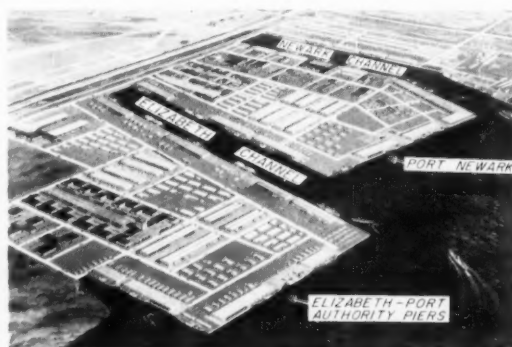
The American Bridge Division of United States Steel Corporation is sponsoring a \$44,000 steel highway bridge design competition open to consulting engineers throughout the world. The problem is to design an overpass structure in steel to carry a two-lane highway at right angles over a four-lane interstate highway on level terrain. Awards in the Professional and Design Engineers category total \$35,000, and include a \$15,000 first prize and a \$10,000 second prize. Deadline for the competition is May 31, 1959. For further information, write to: Steel Highway Bridge Design Competition, American Institute of Steel Construction, Inc., 101 Park Avenue, New York 17, N. Y.

A second contest open to consultants, sponsored by The James F. Lincoln Arc Welding Foundation, is the Machine Design Award Program. Awards totaling \$50,000 will be made for the best papers

describing the use and advantages of arc welding in the design and construction of a machine or machine component. Eligibility in this competition, however, is limited to residents of the United States and its possessions. Entries for this program must be mailed on or before July 20, 1959. All communications should be addressed: Secretary, The James F. Lincoln Arc Welding Foundation, P. O. Box 3035, Cleveland 17, Ohio.

#### New Jersey Marine Development

The Port of New York Authority is spending \$275 million to dredge the new 9000-ft long, 800-ft wide, 35-ft deep Elizabeth Channel along Newark Bay,



Artist's conception of new Port Authority facilities.

to add piers to accommodate 24 vessel berths at Elizabeth, and to expand Port Newark's present berth capacity from 28 to 39. The new facilities will enable the two terminals to handle 11 million tons of cargo annually.

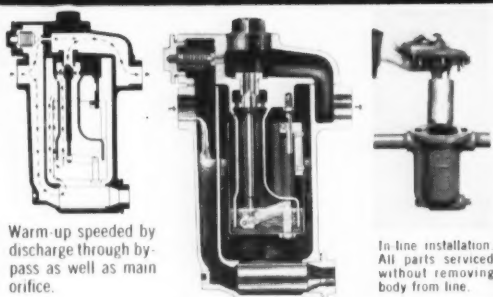
#### Fluoride Emissions Study

Arthur D. Little, Inc. has been retained by the Kaiser Steel Corporation to develop methods of reducing fluoride emissions at the company's Fontana, California plant. Although Kaiser research during the past several years indicates that these fluorides cause no damage to local agriculture, it is hoped to minimize discharge of this air contaminant.

#### California Harbor Improvement

Moffatt and Nichol, Long Beach, California consulting engineering firm, has been selected by Imperial Beach, California as planning consultants for a harbor improvement program. The U. S. Army Corps of Engineers has been asked to make a flood control survey of the Tijuana River Valley that is essential in planning a small-craft harbor. The harbor may require flood wall protection. ▲▲

## Now—A Steam Trap that Adjusts Automatically to Every Operating Condition!



### AUTOMATICALLY REGULATES FOR FASTER WARM-UP AND TO KEEP OPERATING TEMPERATURE AT PEAK HEAT

Proven bucket design with built-in accessories. By-pass thermostatic increases discharge for warm-up and overload conditions. Thermostat compensated to operate at 10° below saturated steam temp. Wright-Austin Airxpel principle provides for mechanical discharge of air after Thermostatic by-pass has closed.

WRITE FOR BULLETIN 808

**WRIGHT-AUSTIN COMPANY**

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# Right off the *Wire*

Before the first nuclear-powered merchant vessel is launched, a new reactor system which has been designed is expected to reduce the cost of a comparable installation by forty per cent.

After leaving a new electric shaver plugged into an outlet overnight it can be used for a week without recharging.

A radio operator's vest, with pockets for dry cells, can be worn under outer garments in arctic cold. The batteries, when kept warm by body heat, are said to last ten times longer.

Automobile batteries are now made with cells which can be removed and replaced in a few minutes.

A new electronic surveying technique, now in use in highway layout work, enables engineers to establish numerous ground control points and measure distances in a matter of minutes. Maximum possible error is only 11 inches in 40 miles.

Copper strip is being made from powdered metal. The process can also be used for other metals which can be combined in 1 other way.

A portable building for use in the arctic has hollow walls of nylon fabric. When the walls are inflated the building stands erect.

A research program has begun for the study of new semiconductors for use in transistors. The materials are indium phosphate, gallium arsenide, aluminum antimonide.

An insulated guard rail for the end of the boom is made to protect a crane operator in case of contact with a power line.

More and better rayon is the object of a study of cellulose growth in living trees. Two-year-old pines are injected with radioactive carbon and are later cut down for examination.

A new plastic adhesive used in aircraft construction is semi-elastic and stronger than the metals it joins.

A new titanium alloy is made into sheets that will withstand air pressures of over 100 tons per square inch.

The "world's loudest noise" can be produced by a new compressed air loud speaker that is capable of projecting the human voice for ten miles.

**Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.**

Twelve pneumatic tires, each supporting a load of 20,000 pounds, enable a new lift to pick up and move concrete pipe sections at five miles per hour.

The Post Office Department has awarded a contract for the development of a mechanical letter-sorting machine.

Aerodynamic shapes designed to travel at over 8,000 miles per hour can be tested in a new wind tunnel.

Layers of steel, bronze and a mixture of lead and plastic compose a new dry bearing material that requires no lubrication.

Coils of aluminum, plastic or steel, up to 82" O.D., can now be spiral wrapped by machine.

A new method of producing electricity uses a fuel cell that converts hydrogen and oxygen into direct current by means of a catalyst.

A new recording instrument measures heat absorption in any area and is used for allocating air conditioning or heating charges to tenants.

Quartz tubing is being made so small that fifty feet contain only one drop of water.

A new heat resistant paper is made of ceramic fibers.



## Simplex Goes To Sea

The 36,000-foot "sea section" of the Simplex submarine communication cable, for use between Cape Neddick, Maine, and Boone Island Light, was loaded in August at Boston.

The cable came off a giant reel (dia. of head 126 inches) and was carried over a capstan to the 126-foot barge.

The cable is described as "4-conductor, No. 9AWG stranded, ANHYDREX insulated, armored submarine communication cable."

The reel and its load of more than six miles of cable weighed 68 tons.

**SIMPLEX WIRE & CABLE CO.**  
Cambridge, Massachusetts and  
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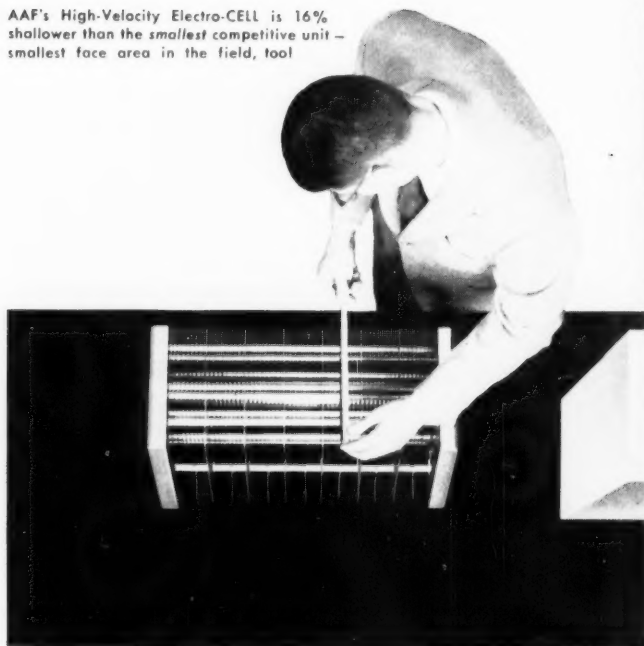
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# AAF *Electro* -CELL . . .

AAF's High-Velocity Electro-CELL is 16% shallower than the *smallest* competitive unit — smallest face area in the field, too!

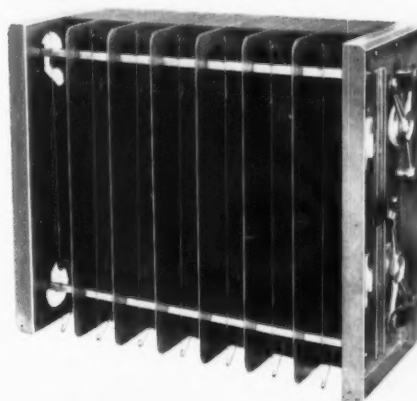
cleaner air  
in a smaller package  
at lower cost



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- Does super-cleaning job at higher velocities than any other unit!
- Shallower, smaller in face area. Requires less space than any other high-velocity precipitator!
- Completely automatic maintenance. Automatic washing schedule can be set to meet the needs of each individual job!
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- The only electronic precipitator having all insulators out of air stream!
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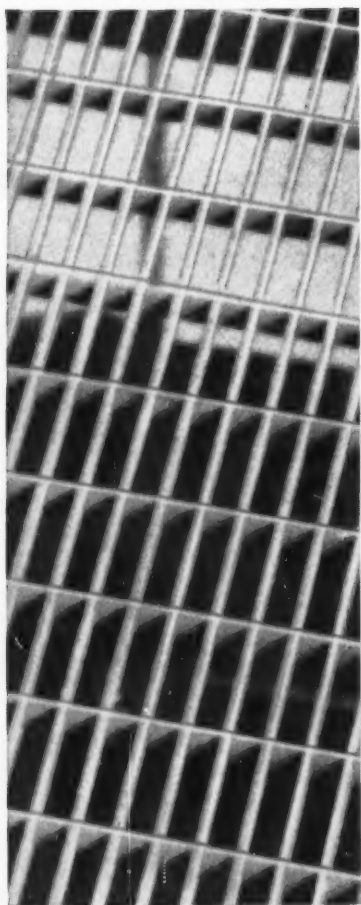
The automatic washing schedule can be set to meet the needs of each individual job.

For complete information, see your local AAF representative or write us direct for Bulletin 258. Address: Mr. Robert Moore, American Air Filter Company, Inc., 300 Central Avenue, Louisville, Kentucky.



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**Hendrick Mitco . . . the grating with the Deep Cross Bar**

## Hendrick

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Robert H. Hendron has opened an office for the practice of consulting engineering at 105 East Sixth Avenue, Helena, Montana.

Arthur G. Tichenor has joined Arthur D. Little, Inc., industrial research and engineering company, as senior staff member in the management services division. Tichenor formerly was manager of manufacturing for the general products divisions of Westinghouse Electric Corporation.

Gee & Jensen, consulting engineers of West Palm Beach, Florida, has opened a branch office at 502 Main St., Dunedin, Florida. Resident engineer is W. A. Arnold. The firm also has branch offices in Cocoa and Ft. Myers.

Converse Foundation Engineering Company has moved its offices and laboratory to 126 West Del Mar Street, Pasadena, California.

Francisco J. Cordova, Engineers and Geologists, have moved their engineering offices and testing laboratory to 2316 West 11th Avenue, Gary, Indiana.

Lockwood, Kessler & Bartlett, Inc., civil engineering consultants, of Syosset, New York and Coates Field service, Inc., right-of-way specialists of Oklahoma City, Oklahoma, have formed a new service to provide a complete engineering

## Men in Engineering

and land acquisition facility for the pipeline and electric transmission industries, including aerial surveys and mapping, route and site study, seismic subsurface investigations, location studies, design, appraisals, title searches, land acquisition, construction supervision, and damage settlements. The two firms are retaining their identities and will function on any specific project as a joint venture.

Chester Valley Engineers, Inc., consulting engineers of Paoli, Pennsylvania, have retained Leon E. Smith as a paper mill consultant. Smith formerly was employed by Rice Barton Corp. and has been active in the paper industry for over 40 years.

Robert M. Wolaver has been named director of functional design of J. M. Little and Associates, industrial designers and consulting engineers of Maumee, Ohio.

Ole F. Melleby, P. E., Eugene N. Catalano, P. E., and Earl F. Sorensen, P. E., have been named project engineers in the firm of Ketchum and Konkell, Consulting Engineers, Denver, Colorado.

Walter E. Joyce, senior associate of D. B. Steinman, Consulting Engineer, New York City, has retired from active practice after 51 years of engineering work. Joyce's special field was the design of suspension

# thrifty cities protect power budgets with SUPERIOR ENGINES



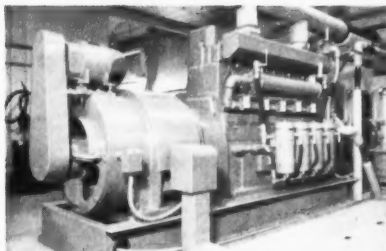
More and more cities with budget-conscious administrators are wisely specifying White Superior diesel or gas engines for water, sewage treatment and power plants. They find that both fuel and maintenance costs are reduced whenever these dependable, economical engine generator sets go to work as prime power, supplementary power or standby power.

Singly or in multiples, compact, completely self-contained Superior power packages consistently produce high output for size. Diesels can operate continuously on non-premium fuel, while gas engines perform efficiently on natural, LP or free sewage gas. Because Superior has simplified engine construction to the highest degree possible—and uses only the most rugged, high quality parts—fewer replacements are required and maintenance is reduced to an absolute minimum.

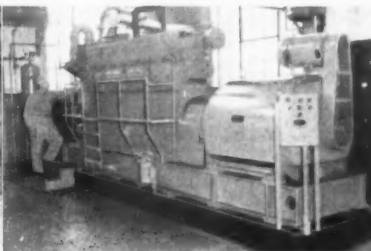
White can custom-engineer Superior engines to your exact requirements and apply its extensive experience with automatic, unattended and remote control operations to your problem. If your requirements range from 215 to 2150 horsepower, or 150 to 1500 KW, call on White Superior engines to protect your power budget!

## White Diesel

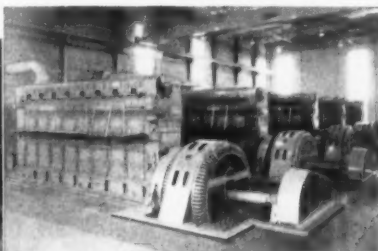
WHITE DIESEL ENGINE DIVISION, WHITE MOTOR COMPANY, Plant and General Offices, Springfield, Ohio



ALBUQUERQUE, NEW MEXICO... Superior 6G-825 gas engine generator set (250 KW) at Sewage Disposal Plant No. 1. Engine operates on sewage gas and/or natural gas.



LIMA, OHIO... Superior 40-SX-8 diesel engine generator set (500 KW) at city waterworks. Unit is on duty as standby power.

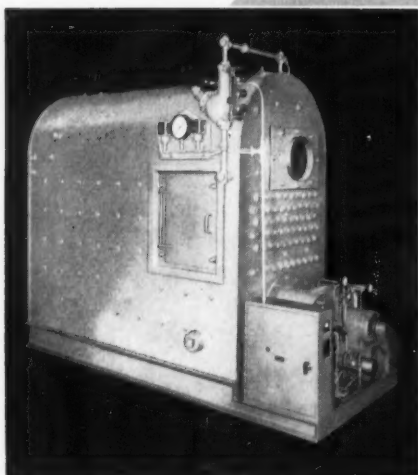


TUCSON, ARIZONA... Five Superior 80-GDSX-8 dual-fuel engine generator sets (each 1000 KW) at TRICO Electric Co-op Inc. County-wide power for farming and residential requirements.

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erators • ASME Code Pressure  
Vessels & Welded Products.

bridge cables and some of his projects included the George Washington Bridge, the Golden Gate Bridge, and the Mackinac Bridge.

J. H. Foote has relinquished his duties as president of Commonwealth Associates, Inc., and now will serve solely as chief engineer of the Jackson, Michigan consulting firm. Jack R. North has been named the new president.

Jack Wood has been named an associate of Harland Bartholomew and Associates, of St. Louis, Mo. Wood formerly was professor of city and regional planning at the University of Illinois.



WOOD



COLE

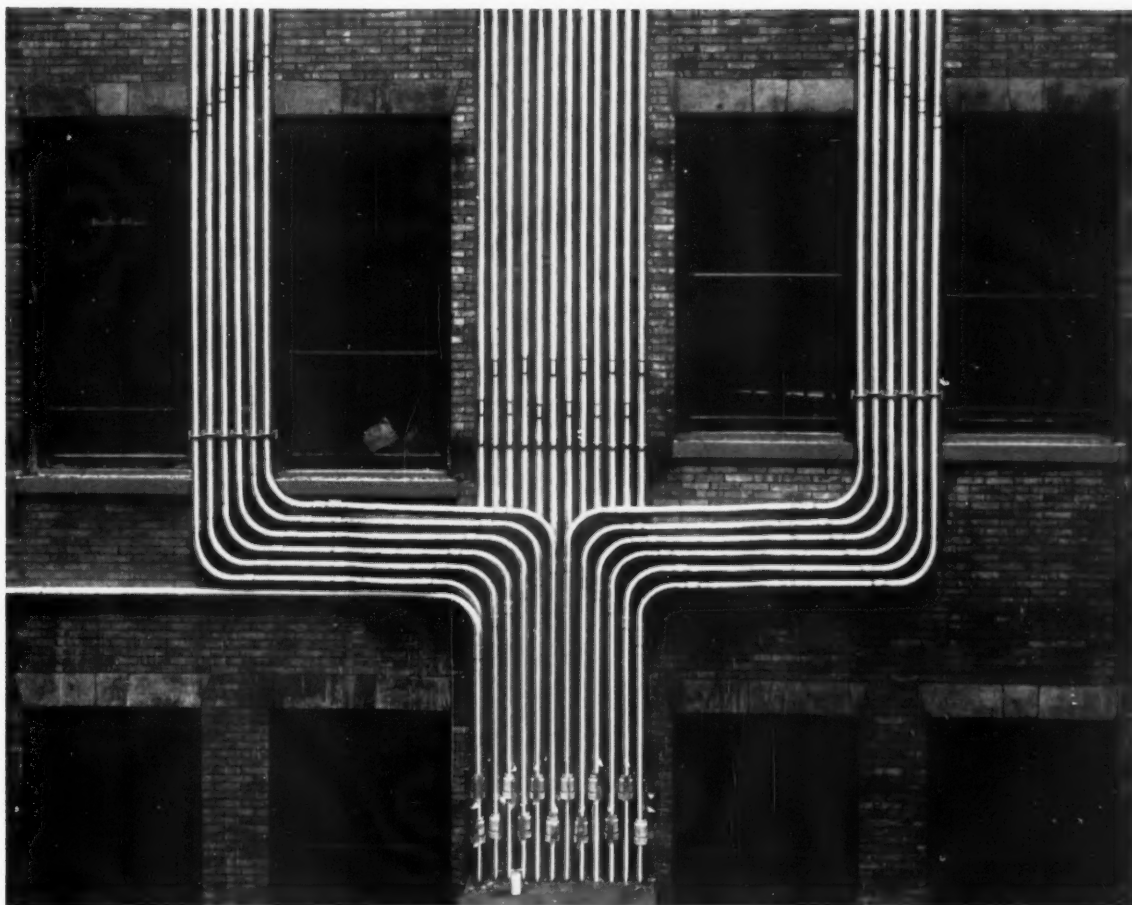
Donald C. Cole has joined the firm of Bernard Johnson & Associates, Consulting Engineers, Houston, as temperature control and instrumentation specialist.

Robert R. Wagstaff, chief engineer, United Engineers & Constructors, Inc., Philadelphia, has been made a Fellow of the American Institute of Electrical Engineers "for his contributions to design and execution of large power projects."

Burr W. Hupp and Richard J. Sweeney have been appointed principals of Drake, Startzman, Sheahan and Barclay, distribution and materials handling consultants, New York City.

George A. Hess now is associated with J. Y. Long Co. Engineers of Oakland, California, as a project engineer. Hess formerly was vice

CONSULTING ENGINEER



## Why Alcoa Aluminum Rigid Conduit Proved to Be the Best Buy for an Ebasco Remodelling Job

In planning to expand the electrical capacity of a 26-story New York office building, the budget dictated that existing external shutter brackets be used for conduit supports. It was doubtful that they would support the weight of steel conduit. The only alternative was a more expensive breaking through of walls and floors inside the building.

The solution proved to be Alcoa® Aluminum Electrical Rigid Conduit. Twenty-four 2½-in. risers were installed on the exterior of the building from painter's scaffolds. The light weight of aluminum conduit made the job easier and faster and reduced labor costs. Further, no maintenance should ever be necessary because aluminum resists corrosion and staining and will never need painting.

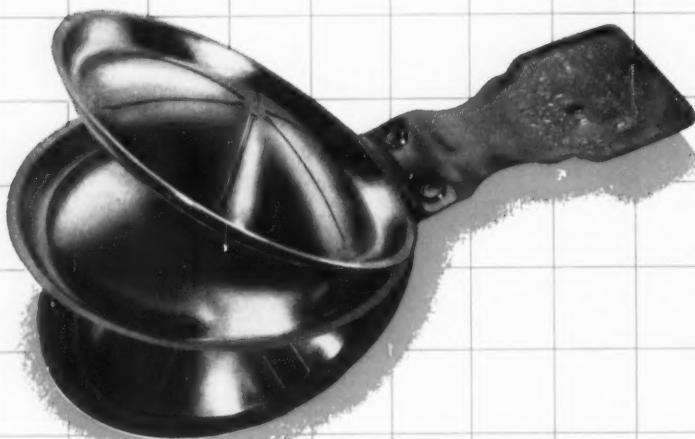
For new plants and offices, too, new low prices in all sizes can make aluminum your most attractive conduit buy. Alcoa Rigid Conduit in sizes up to 6 inches is furnished with color-coded thread protectors to tell conduit size at a glance. For more information, call Alcoa, or contact your Alcoa Conduit Distributor. Aluminum Company of America, 2328-A Alcoa Building, Pittsburgh 19, Pa.

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## "Difficult" Pressure Protection Problems?



## Solve Them With... **BS&B** *Safety Heads!*

BS&B's D and DV Rupture Discs, which are fully interchangeable in BS&B Safety Head flanges with conventional type pre-bulged discs, are engineered to give highly desirable Safety Head protection to those pressured systems in which one or more of the following "difficult" conditions prevail:

1. When operating pressure must be close to relief pressure.
2. When high operating temperatures are involved.
3. When alternating pressure and vacuum prohibits the use of standard one-layer rupture discs.
4. When pulsating pressure conditions prevail.
5. When a combination of metal and plastic disc construction is needed to obtain lower rupture pressures.

### BS&B D and DV Rupture Discs have these advantages:

1. Fast action and unrestricted relief openings.
2. Wider rangeability in selection of metals and plastics for disc components.
3. Longer service life.
4. Rugged construction for added protection against possible damage by rough handling.



Let BS&B Safety Heads solve your pressure protection problems. Our engineers will gladly evaluate your pressure system to assist you in proper selection of Safety Heads.

**BLACK, SIVALLS &  
BRYSON, INC.**

Safety Head Division, Dept. 2-FX1  
7500 East 12th Street  
Kansas City 26, Missouri  
Telephone: BEnton 1-7200

president and chief engineer of Rosener Engineering, Inc., San Francisco.

Thomas A. Fearnside, chief mechanical engineer of Stone & Webster Engineering Corporation, has recently been elected a Fellow of the American Society of Mechanical Engineers.



FEARNSIDE



KADDY

C. E. Kaddy, Jacob C. Muskin, and E. Roy Sweet have been elected partners of Singmaster & Breyer, New York City metallurgical and chemical process engineers. The three have been associated with the firm for many years — Kaddy as construction manager, Muskin as chief structural engineer, and Sweet as manager of chemical engineering.

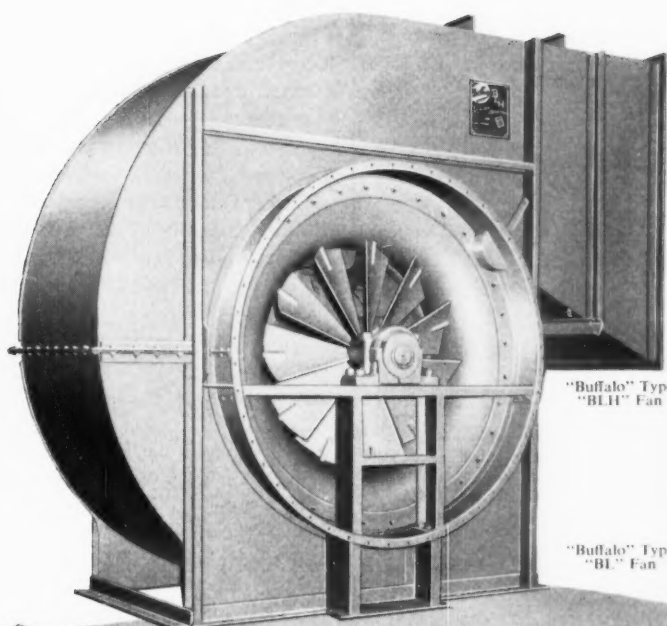


MUSKIN

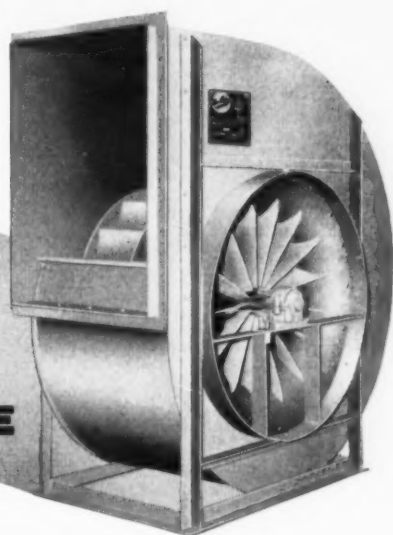


SWEET

North Pacific Consultants, Portland, Oregon, and Anchorage, Alaska engineering consulting firm, has announced the expansion of its partnership and key personnel. The mechanical engineering firm of G. E. Wieland and Associates has joined the partnership of Ivan Bloch and Associates, industrial and economic consultants of Portland, N. W.



"Buffalo" Type  
"BLH" Fan



"Buffalo" Type  
"BL" Fan

## SPECIFY PERFORMANCE NOT PROMISES

*Promised* catalog ratings and actual on the job ratings are not always the same. When you specify "Buffalo" Fans you can always be sure that fan *performance* will confirm your good judgment. Buffalo Forge Company's 81 year reputation for highest engineering and manufacturing standards is assurance that you will obtain fan performance to meet the *exact* requirements of each job.

### FOR HIGH PRESSURE REQUIREMENTS:

Designed especially for Class III and IV construction, the "Buffalo" Type "BLH" fan will provide peak performance for your high pressure systems. It affords a mechanical efficiency of 86% over a wide range, while maintaining stability of performance from free delivery to shutoff. The "BLH" features a smooth inlet bell, directional inlet vanes, backward-curved blades and divergent outlet. These factors reduce turbulence to a minimum, and give very

quiet operation. An added feature is the non-overloading characteristic. Bulletin F-201 gives complete details.

### FOR MODERATE PRESSURE REQUIREMENTS:

The "Buffalo" Type "BL" Fan is an ideal choice for your Class I and II ventilating and air conditioning installations. Its high static efficiency over a broad range has been proved in hundreds of applications. The "BL" has many of the unique "Buffalo" features of the "BLH": it is non-overloading, and is designed for minimum turbulence and ultra-quiet operation. Other features are the factory-balanced wheel to minimize vibration and the wheel-contoured housing with large, correctly-shaped scroll. Write for Bulletin F-104.

Only "Buffalo" offers you the "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

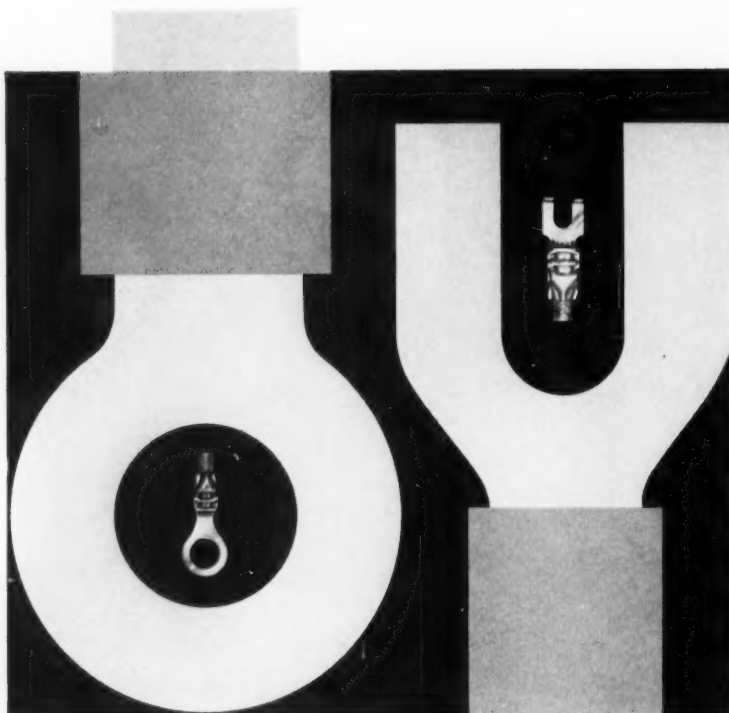


## BUFFALO FORGE COMPANY

Buffalo, N. Y.

Buffalo Pumps Division • Buffalo, N. Y.  
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING  
FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING



For perfect insulated termination . . .

faster . . . specify the



**PRE-INSULATED DIAMOND GRIP terminal**

If you need terminals with bonded insulation—if you need corrosion resistance and wire-supporting vibration resistance—you have it instantly in one closure of A-MP's matched crimping tool. Only one lightning-quick step for crimp-sure optimum strength and conductivity. A-MP PRE-INSULATED DIAMOND GRIP Terminals exceed the most rigid military and commercial specifications.

A-MP's precision-engineered terminals are matched to precision-engineered tools that make an exact crimp every time, never too little, never too much. Perfect terminations—whether you need one or a million. No great operating skill necessary. A-MP's match-mated tooling does all the work and at lower installed cost than other methods of wire termination. Wire range is from No. 26 to No. 10.

To solve your wire-end problems, we maintain an international engineering service.

For the full story on the A-MP PRE-INSULATED DIAMOND GRIP line, send for our catalog.

**A-M-P INCORPORATED**

**General Offices: Harrisburg, Pennsylvania**

A-M-P products and engineering assistance are available through wholly-owned subsidiaries in: Canada • England • France • Holland • Japan

Haner and Associates, civil engineers of Portland, and Robert W. Retherford, electrical engineers of Anchorage, Alaska.

Also joining the firm in key positions are Stanley E. Sporseen, civil engineer, formerly head of the Project Planning Section of the Portland District of the U.S. Corps of Engineers, Clayton Mundt, civil engineer formerly with Tacoma Utilities, and Theodore W. Troost, electrical engineer, formerly with Pacific Power and Light Company.

Edward Doran has been appointed project engineer of Davidson-Kennedy Associates Company, designers and constructors of chemical and food plants.

Prof. Donald L. Katz, chairman of the Department of Chemical and Metallurgical Engineering at The University of Michigan, was elected president of the American Institute of Chemical Engineers during the AICE annual conference held in December. He assumes the one-year post January 1.

The name of Pereira & Luckman, planning, architectural, and engineering firm of Los Angeles and New York, has been changed to Charles Luckman Associates. Marvin G. Sturgeon, Ventura county director of public works for the past three years, has been named a vice president of the firm.

Harold A. Mosher, assistant director of engineering for the Eastman Kodak Company, Rochester, N. Y., has been nominated for the office of president of the National Society of Professional Engineers. Mosher currently is serving as a National Society vice president for the Northeastern Region.

Six regional vice presidents and a treasurer also were nominated for the administrative year which begins July 1959. They are: W. Earl Christian, Westfield, N. J., Northeastern Region; R. King Rouse, Greenville, S. C., South-

## Engineering the temperature...

with a ONE PIECE, 233 TON Evaporative Condenser. Factory assembled and shipped as a unit, the compact DF-41A is only 93" high, 96" wide and 247" long.

**RECOLD CORPORATION**  
7250 East Slauson Avenue, Los Angeles 22, California



233 TON  
EVEN  
RE



**FOR A NEW PERSPECTIVE  
ON HEATING, COOLING and  
AIR CONDITIONING EQUIPMENT**



**Young**

**SPECIALISTS IN  
HEATING, COOLING  
and AIR CONDITIONING**

**SEE WHAT THE YOUNG  
APPROACH TO ECONOMY  
THROUGH QUALITY  
CAN DO FOR YOU!**

Young Design and Engineering deliver outstanding value and performance in each of their lines of heating, cooling and air conditioning products. Longevity and satisfaction through quality is the Young approach to economy. Note the products listed here. See them at our booth at the Exposition at Philadelphia January 26-30. Get a preview by sending for the product catalogs which interest you. Compare performance ratings and features with competitive products. You will find that Young Specialists offer a sound solution to practically every type of heating, cooling and air conditioning problem. See what Young Heat Transfer Specialists can do for you.

See You at the 14th International  
Heating and Air Conditioning Exposition.  
**JANUARY 26-30 • BOOTH 848**

**YOUNG RADIATOR COMPANY**

Racine, Wisconsin — Dept. 499-A

*New* Central Station  
Air Conditioning Units  
Catalog No. 7558

*New* Remote Roomaire®  
Conditioning Units  
Catalog No. 7758

*New* Vertiflow® Unit Heater  
Catalog No. 2658

*New* Heating Coils  
Catalog No. 4558

*New* Cooling Coils  
Catalog No. 5559

**Other Lines**

Cabinet Unit Heaters  
Catalog No. 6556-A

Gas Fired Unit Heaters  
Catalog 2758

Horizontal Unit Heaters  
Catalog 2557

Convactor Radiators  
Catalog Nos. 4049-A  
& 4150

Perimaheat®  
Baseboard Convectors  
Catalog No. 4354-A

eastern Region; L. Eugene Easley, Indianapolis, Ind., Central Region; Brandon H. Backlund, Omaha, Neb., North Central Region; Noah E. Hull, Houston, Texas, Southwestern Region; and George E. Zelhart, Fresno, Calif., Western Region. Russell B. Allen, College Park, Md., was nominated for treasurer.

Hill & Ingman, Seattle consulting engineers, announce the appointment of V. O. Rockett as director of engineering publications

James Posey, a partner in the firm of James Posey and Associates, Baltimore, Maryland, has been elected to the grade of Fellow in the American Society of Mechanical Engineers.

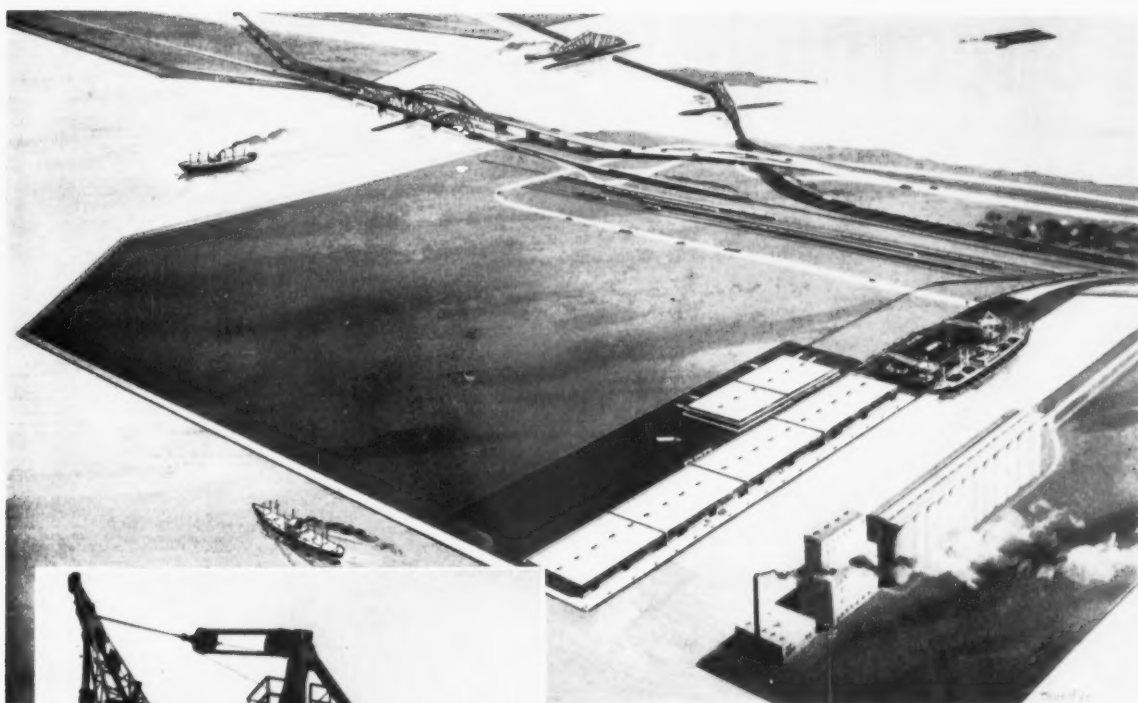
Walter J. Douglas, professional engineer and John E. Cadman, architect, principals in the firm of Walter J. Douglas Associates, announce the removal of their offices to 17 South Highland Street, West Hartford, Connecticut.

A new firm, Wikle & Einik, Engineers, has been formed for the practice of civil and mechanical engineering and structural design. Principles are Kenneth C. Wikle and Peter F. Einik. Address of the new firm is 11941 Wilshire Boulevard, Los Angeles 25, Calif.

Jack R. Barnes, Engineer-Geologist, and J. R. Barnes Engineering Company have moved to 9115 Burnet Road, Austin, Texas.

William Hunter Owen, assistant director of the Division of Sanitary Engineering of the Tennessee Department of Public Health, has become an associate member of Barge, Waggoner & Sumner, consulting civil engineering firm of Nashville, Tennessee.

Louis J. Kormendy has been appointed chief electrical engineer of Benedict & Associates, Inc. of Detroit, Michigan. ▲▲



## 2 90-ton Clyde Whirleys to serve new marine terminal at Duluth

When the Public Marine Terminal at the Port of Duluth, Minnesota opens in May, 1959, two Clyde Whirleys, the finest, most modern cranes available, will be on hand to handle cargo with hook, bucket, or magnet.

Each of the cranes can pick up 90 tons at a 35 foot radius, swing it smoothly and safely in a full circle and place it gently and accurately in position.

Handling loads of many tons, in tandem or individually, either into or out of a ship's hold, is a ticklish job that requires absolute load control at all times. Booming, swinging and traveling are other operations that can only be safely accomplished with positive crane stability. The higher standards of quality that are incorporated into Clyde Whirleys . . . the utilization of the safest, most advanced system of controls . . . the best materials and workmanship throughout, are but a few of the many advantages that have made Clyde Whirleys the undisputed choice of leading ports all over the world.

*"For Faster, More Economical and Safer Cargo Handling, Check the Features of Clyde Whirleys. Send for Bulletin 12-P."*

If you have a cargo handling problem, consult Clyde, recognized throughout the world as leaders in equipment for dock or deck cargo handling.

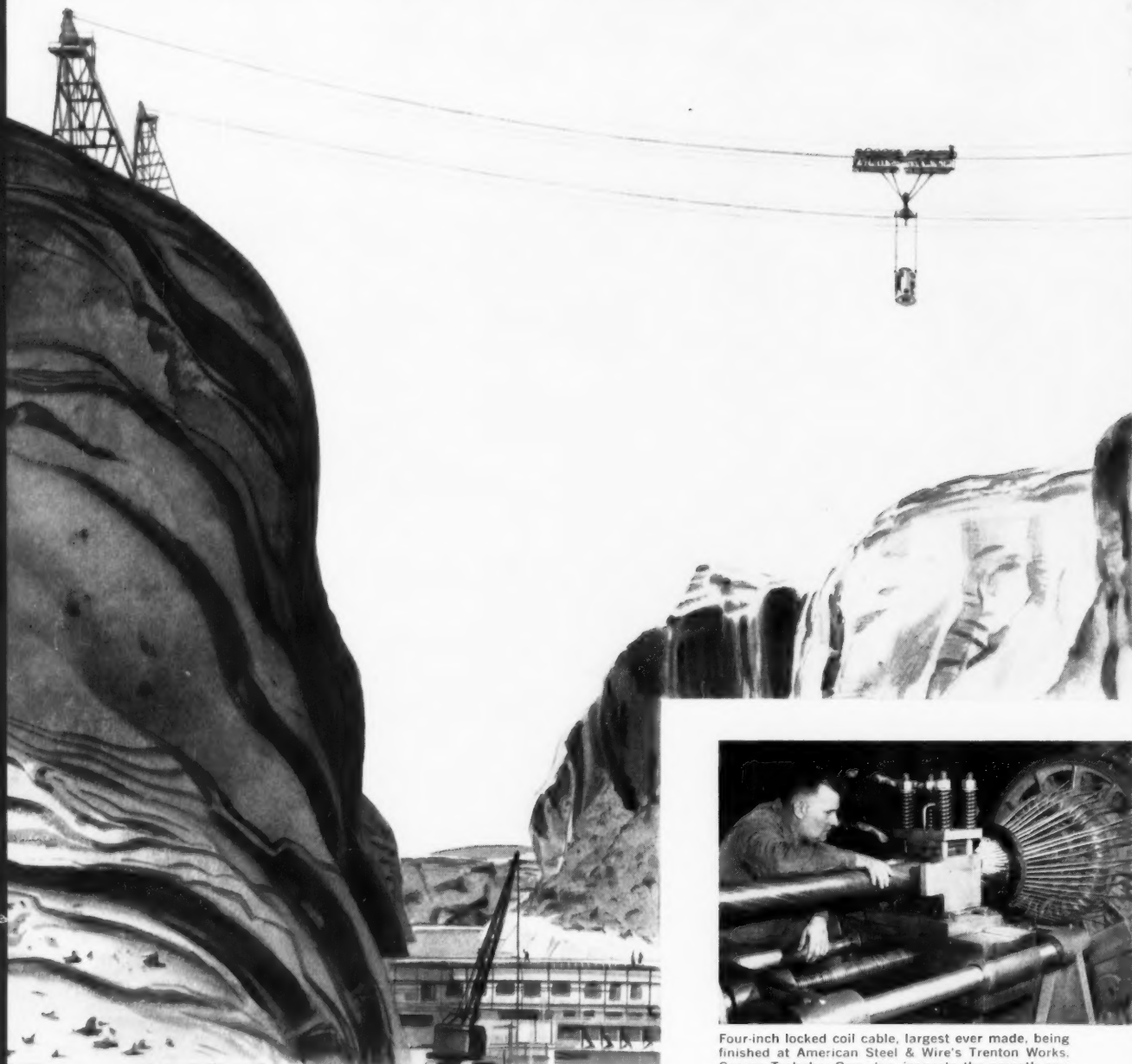


## CLYDE IRON WORKS, INC.

Established 1899  
DULUTH 1, MINNESOTA

HOISTS : DERRICKS : WHIRLEYS : BUILDERS TOWERS  
UNLOADERS : CAR PULLERS : ROLLERS

# Superhighways in the sky



Artist's conception of how the two Tiger Brand Cableways will be used in the construction of Glen Canyon Dam on the upper Colorado River. The higher cableway can pass over the lower one. Both can service all areas of the construction site.

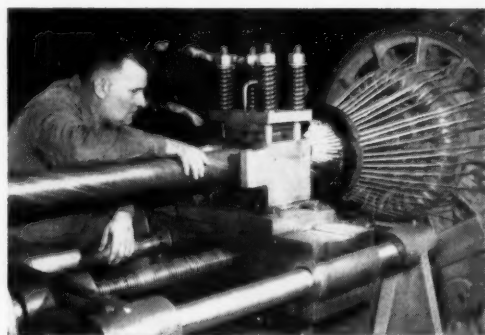
## GLEN CANYON DAM

700 FEET HIGH—1400 FEET LONG

Second highest dam in the United States, located on the Colorado River in northeastern Arizona.

Ranks with the greatest dam projects ever undertaken and is a key feature of the U. S. Bureau of Reclamation's \$400-million Colorado River Storage Project.

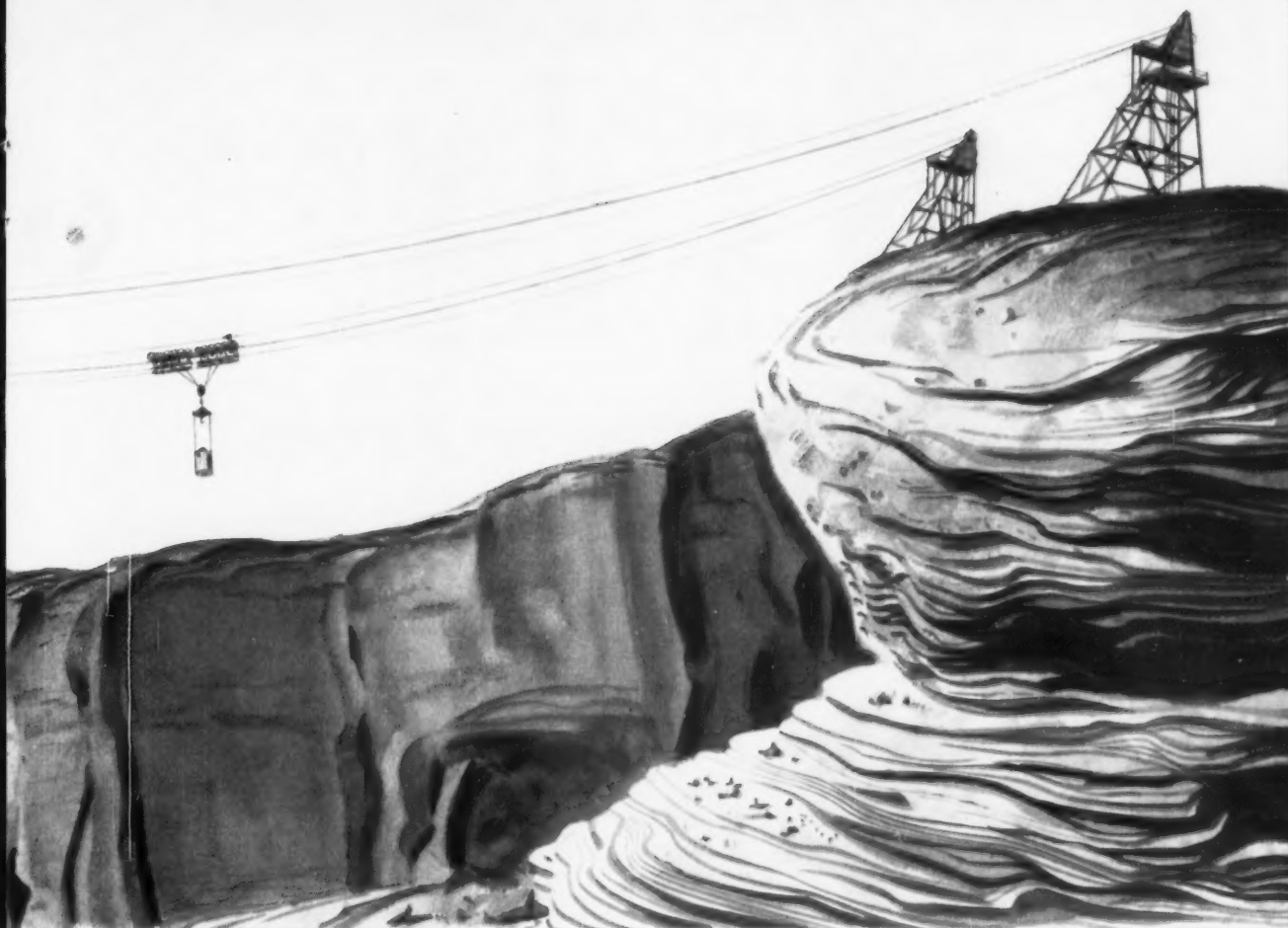
- Reservoir capacity—28,040,000 acre feet with a lake 186 miles long.
- Power capacity—900,000 kw. in eight generators.
- Volume of concrete in dam proper—4,770,000 cu. yd.
- Contract for dam and power house—\$108 million, awarded to Merritt Chapman & Scott Corp.
- Cableway contractor: Kiewit-Judson Pacific Murphy Co.



Four-inch locked coil cable, largest ever made, being finished at American Steel & Wire's Trenton Works. George Trahuba, Operator, inspects the smooth surface of the cable which will support cableway buggies capable of handling 50 tons of construction material.

Perplexed porcupine, "Sticky," inspects short "broomed-out" length of the main cable made up of 312 steel wires. Over 145 tons of the cable have been made for the new dam's cableways.





## Glen Canyon cableways ... largest ever made!

**M**EN LOOK like midgets against the backdrop of Glen Canyon—but they are building a giant-size dam on the Colorado that will make a lake 186 miles long.

*Glen Canyon* will be the country's second highest dam. Its 700-foot height is topped only by the 726-foot Hoover Dam. It will require 4,770,000 cu. yds. of concrete which will be poured from two 50-ton-capacity cableways using 12-cu.-yd. buckets. This looks like an endless job, but these cableways really make speed. The contractor is aiming for an unprecedented rate of 9,000 cu. yd. daily—50% more than has previously been possible.

The track cable, or "main gut" as it is called by the dam builders, is the

largest ever built. It is a 4-inch-diameter USS Tiger Brand Locked Coil Cable built at the Trenton, N. J., plant of American Steel & Wire. It has a strength of 880 tons, weighs 38 pounds per foot, and operates at a tension of 640,000 pounds. Tiger Brand operating ropes of 1½-inch diameter will also be used on this equipment to safely convey, raise and lower the loads into position.

At the dam, one of the two cableways stretches 2,050 feet between two traveling towers on opposite sides of the Colorado River. The second 1800-foot cableway connects two shorter towers allowing the higher span to pass over the top. Working together, the cableways can place 100-ton loads such as large steel penstock sections. They can

handle work in any construction area at the dam.

Another Tiger Brand Cableway using a 3-inch cable 1,490 feet long is helping to build the Colorado River Bridge, the nation's highest and second longest steel arch span.

*Tiger Brand Wire Rope* is engineered to fit the job . . . engineered by one of the finest staffs in the country and backed by the basic research of the United States Steel Corporation. Next time you need wire rope, rig up with Tiger Brand. It will keep your machines on the job. Write American Steel & Wire, 614 Superior Avenue, N. W., Cleveland 13, Ohio.

*USS and Tiger Brand are registered trademarks*

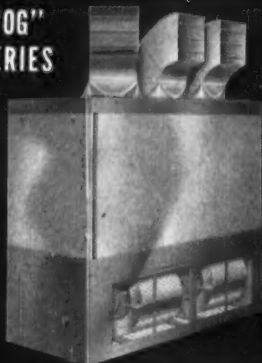
**American Steel & Wire  
Division of**



**United States Steel**

Columbia-Germain Steel Division, San Francisco, Pacific Coast Distributors Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors United States Steel Export Company, Distributors Abroad

"OG"  
SERIES



**LENNOX**

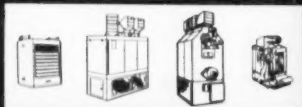
brings a  
*New Era*  
to Industrial Heating

- One Unit for Space Heating, Ventilating, Make-Up Air, Oven Applications and Drying
- Gas, Oil or Combination Burners
- Automatic or Manual Fuel Selection

Never before has one heater handled so many jobs so well, at such a sensible cost.

Completely proven and tested, the "OG" series can be used as a central system... with ducts... or as a unit heater. Installation may be horizontal, vertical, suspended or floor mounted. Dynamically balanced blower delivers a huge volume of air... with super-quiet action. But this just begins the "OG" story... write for full specs... see for yourself how Lennox has made the basic change in industrial heating.

**LENNOX "Task Matched" Equipment**  
to control and condition air for industry



64,000 to 2,000,000 Btu/h Units

**CLIP AND MAIL FOR  
FREE SPEC SHEETS**

**LENNOX Industries Inc.**

INDUSTRIAL DIVISION  
1701 East Euclid, Dept. CE-1,  
Des Moines, Ia.

Please send me—without obligation—complete specifications and engineering data on Lennox "OG" Series Industrial Heaters

Name \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_ City \_\_\_\_\_  
Title \_\_\_\_\_



## New Projects Reported

By Consulting Engineers

### ARIZONA

Johannessen & Girard

Phoenix, Arizona

† Taxiway and runway, Yuma, Ariz. (civil, struc., mech., elec.) \$7.4 million. Client, U.S. Navy.

Van Lee Schmidt, Architect & Engineer

Hollywood, California

† Spanish food restaurant, Phoenix, Ariz., detail concrete block walls, wood laminated roof, steel beams and columns, composition floors, cork ceiling, air conditioning, heating, and ventilating, kitchen equipment, restaurant counter equipment, booths, lighting, power, and plumbing. (civil, struc., mech., elec.) \$75,000. Client, Mrs. J. Olsen, owner, and R. A. Rodriguez, Architect.

### CALIFORNIA

Clair A. Hill & Associates

Redding, California

† 570-unit housing project, Beale Air Force Base. (civil, struc., mech., elec.) \$10 million. Client, U.S. Air Force.

† Stumpy Meadows dam and El Dorado ditch, Georgetown, Calif. (civil) \$4.2 million. Client, Georgetown Divide Public Utility District.

† Addition to Shasta County Hospital, Redding, Calif. (struc.) \$500,000. Client, Smart & Clabaugh, Architects.

Bleifuss, Hostetter & Associates

Sacramento, California

† Concrete dock facility for Transportation Corps, U.S. Army, at Rio Vista, Calif. (civil, struc., mech., elec.) \$180,000. Client, Corps of Engineers, Sacramento District.

### CONNECTICUT

Meyer, Strong & Jones

New York, New York

† Southern New England Telephone

Company, New Haven, Conn. (mech., elec.) \$11 million. Client, Southern New England Telephone Company.

### GEORGIA

August E. Waegemann & Associates

San Francisco, California

† Delta Air Lines jet overhaul and maintenance base, Atlanta, Georgia. (civil, struc., mech., elec.) \$6 million. Client, Parr Engineering Co.

### ILLINOIS

George J. Chlebicki & Associates

Harvey, Illinois

† Sewers, clearing, grading, and paving of roads. (civil) \$200,000. Client, Village of Dixmoor.

### LOUISIANA

J. S. Boyd and Associates

Shreveport, Louisiana

† Complete sanitary sewage collection system and treatment plant, Bernice, La. (civil) \$300,000. Client, Mayor Taft Burns, Town of Bernice, La.

Forrest and Cotton, Inc.

Dallas, Texas

† Report and plans and specifications for levees and channels on Sulphur River and Cooper Dam and reservoir. \$13 million. Client, Corps of Engineers, New Orleans District, Louisiana.

### MICHIGAN

Michigan Associates

Lansing, Michigan

† Master plan and 20-year construction plan for City of Allegan. Client, City of Allegan, Michigan.

† Preliminary plans and construction plans and specifications for approximately 3.1 miles roadway grade and surfacing and appurtenant work for Meridan

# ...WHY you should insist on double-source control and full phase protection in your Automatic Transfer Switch

**Double source control**—operating power for the switch must be obtained from the monitored source to which the load is being transferred; otherwise the transfer might be made to an inadequate source, or transfer may be impossible despite the availability of the preferred or normal source of supply.

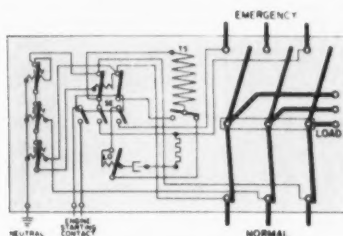
**Full phase protection**—provides load transfer to emergency when any normal line voltage falls below 70% and returns the load to normal when all normal line voltages have been restored to 90% or more. Protection against phase failure or voltage drop below 70% across the outside wires on a 3 wire single phase system is also provided. This protection is particularly recommended when motor loads are involved. Operation on low voltage or single phasing on 3 phase motors will result in overheating and damage.

## ASCO Automatic Transfer Switches provide...

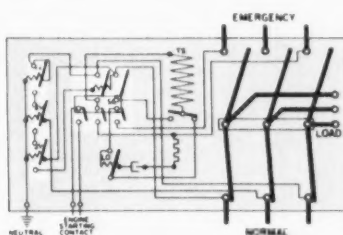
**Double source control**—Additional protection is built into ASCO equipment through the use of a monitoring lockout relay, to assure load transfer only when the new source reaches proper voltage and frequency. Until this condition is reached, the switch is mechanically locked to the original source, utilizing whatever power is available.

**Full phase protection**—ASCO industrial type voltage relays constantly monitor all phases of the normal source so that a drop in voltage or failure of one leg on 3 wire, or phase failure on 4 wire, automatically initiates transfer. Full phase relays will start transfer when voltage of the normal source drops to 70% or less. Retransfer to normal cannot be made until all phases are 90% or more. For critical loads, full phase relays are furnished with adjustable drop out set as high as 90% or pickup at 95%.

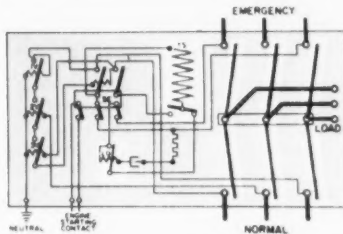
The accompanying wiring diagrams show how ASCO Automatic Transfer Switches provide all these essential provisions against power outage.



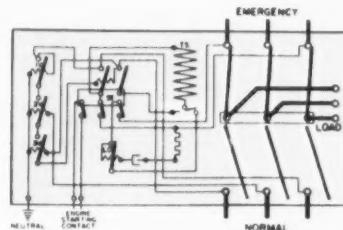
1.  
Normal functioning of ASCO Automatic Transfer Switch. Full phase protection is provided by Voltage Relays 1V, 2V and 3V



2.  
Normal source voltage drops below 70%. Voltage Relays open, de-energizing Source Selector Relay SE. Lockout Relay LO is still open, waiting for emergency source to attain proper voltage and frequency. Load is still connected to original source because of mechanically held movement in ASCO Switch.



3.  
Emergency source now adequate. LO closes, permitting coil TS to be momentarily energized, causing transfer to proceed. **Note double-source control:** operating power for transfer is obtained from the source to which the load is to be transferred. Transfer occurs instantaneously!



4.  
Transfer has taken place. Emergency power is feeding the load. Switch remains on emergency source until Full Phase Relays perceive restoration of normal source to 90% or better. At that time Relays effect closing of top contacts of SE and return to normal source occurs.



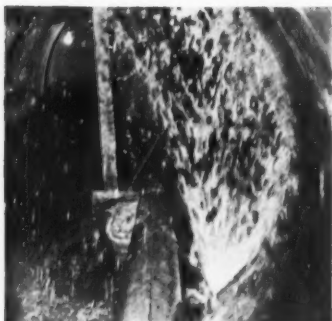
Write for Catalog 57-51 and for Publication 596 describing how to select Automatic Transfer Switches.

## Automatic Switch Co.

50 CC Hanover Road, Florham Park, New Jersey • FRontier 7-4600

AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL





## HIGH PRESSURE LEAKAGE CHOKED OFF WITH SIKA NO. 2



In tunnels, dams, deep basements and similar structures, Sika No. 2 will choke off tons of water under extreme pressure. It is a red liquid that, when mixed with portland cement, causes mortar to set within 15 to 30 seconds. Sealing is accomplished from the inside without the necessity of relieving pressure.

Moderate pressure leaks are sealed with Sika No. 4A. Mortar made by mixing this clear liquid with cement, will set within 45 to 60 seconds sealing seepage quickly and firmly.

Sika Quicksets produce an adhesive mortar that does not dilute or wash away. Very little heat is produced during hardening. Plugging is fast and dependable, thus saving both time and money.

For complete information on Sika Quicksets, write for Bulletin QS-57.

26-23



**SIKA CHEMICAL CORPORATION**  
PASSAIC, NEW JERSEY

DISTRICT OFFICES: ATLANTA • BOSTON • CHICAGO  
DALLAS • DETROIT • NEW ORLEANS • PHILADELPHIA  
PITTSBURGH • SALT LAKE CITY — DEALERS IN ALL  
PRINCIPAL CITIES — AFFILIATES AROUND THE WORLD

Line Road from Heatherton, north to Gibbs Road, Michigan. \$78,000. Client, Ostego County Road Commission.

† US-16 bypass northeast of Grand Rapids, 11 bridges and overpasses. (civil) \$2.1 million. Client, State of Michigan.

† 13 structures on US-12 (relocation) from Michigan-Indiana state line north-easterly to south of Bridgman. \$2,469,000. Client, State of Michigan.

### MISSOURI

#### Dwyer & Kite

Kansas City, Missouri

† One-million bushel grain elevator, truck dump, track sink. All-steel construction. Randolph, Mo. (civil, struc., mech., elec.) \$350,000. Client, Randolph Elevator & Storage Co.

#### Ervin Colnon

Saint Louis, Missouri

† Petroleum coke calcining facility. (civil, struc., mech., elec.) \$1.6 million. Client, General Carbon & Chemical Corp.

### NEW MEXICO

#### Dr. Marcello Giomi, P. E.

Albuquerque, New Mexico

† Eagle senior high addition, Hobbs, N.M. (mech.) \$300,000. Client, Frank M. Standhardt, Architect.

† Yucca elementary school, Albuquerque, N.M. (mech.) \$350,000. Client, Burwinkle & Milner, Architects.

† Zuni elementary school, Albuquerque, N.M. (mech.) \$350,000. Client, Louis G. Hesselden, Architect.

† El Capitan elementary school, Roswell, N.M. (mech.) \$175,000. Client, Frank M. Standhardt, Architect.

### NEW YORK

#### Yost, Bromfield & Hess

Clearfield, Pennsylvania

† Delaware Rural Electric Cooperative, Delhi, New York. (elec.) \$4000. Client, Delaware Rural Electric Cooperative.

† Steuben County Rural Electric Cooperative, Bath, New York. (elec.) \$4000. Client, Steuben County Rural Electric Cooperative.

† Hammondport Telephone Company, Hammondport, New York. (elec.) \$6200. Client, Hammondport Telephone Company.

#### Stresscon Associates

Newark, New Jersey

† Spring Valley General Hospital, Ramapo, New York. (struc.) \$800,000. Client, Samuel Lewis Malkind, Architect.

### OHIO

Fulton, Dela Motte, Larson, Nassau & Asso.

Cleveland, Ohio

† Kent Hall — remodeling, air conditioning, Kent State University, Kent, Ohio. (civil, struc., mech., elec.) \$250,000. Client, State of Ohio.

† New Euclid junior high school, Euclid, Ohio. (civil, struc., mech., elec.) \$1-

175,000. Client, Euclid Bd. of Education. † New Lorain high school, Lorain, Ohio. (civil, struc., mech., elec.) \$3.5 million. Client, Lorain Board of Education.

### OREGON

#### Cornell, Howland, Hayes & Merryfield

Corvallis, Oregon

† Foundation study at Rock Creek dam, involving core drilling to determine if foundation is adequate to support 70-ft high earth and rock fill dam, Corvallis, Oregon. (civil) \$150,000. Client, City of Corvallis, Oregon.

### PENNSYLVANIA

#### Franklin & Lindsey

Philadelphia, Pennsylvania

† Development in Roxborough, Philadelphia, Pa., 496 twin houses with three miles of streets and sewers. (civil) \$1.5 million. Client, Felix Clauss & Sons.

#### Paul H. Yeomans

Philadelphia, Pennsylvania

† Keebler Biscuit Co., Philadelphia, Pa. (mech., elec.) \$1,250,000. Client, Lyle F. Boulware, Architect.

† Montrose Consolidated School, Montrose, Pa. (mech.) \$1.5 million. Client, Wolf & Hahn, Architects.

† 12-story office building, Bala-Cynwyd, Pa. (mech., elec.) \$5 million. Client, Aaron Colish, Architect.

#### Yost, Bloomfield & Hess

Clearfield, Pennsylvania

† Curwensville, Pa. (civil) \$51,947. Client, Curwensville Municipal Authority.

### SOUTH CAROLINA

#### J. C. Harrison, Consulting Engineer

Spartanburg, South Carolina

† Spartanburg city jail and police headquarters. (mech.) \$400,000. Client, D. W. Cecil, Architect.

† Spartanburg county library. (mech.) \$400,000. Client, Hollis & Richards, Architects.

### SOUTH DAKOTA

#### Scott Engineering Company

Watertown, South Dakota

† Sewage treatment plant and outfall line. (civil) \$170,000. Client, City of Moberg, S. D.

† Rebuild two telephone exchanges. (elec.) \$350,000. Client, Sanborn Telephone Cooperative, Woonsocket, South Dakota.

### TENNESSEE

#### William J. Funk, Engineer

Chattanooga, Tennessee

† Factory building, complete layout. \$70,000. Client, Sherman & Reilly.

† Office building. (struc.) \$60,000. Client, Butler & Wilhoite, Architects.

† Two schools and two churches. (struc.) \$200,000. Client, Butler & Wilhoite, Architects.

# CLARAGE



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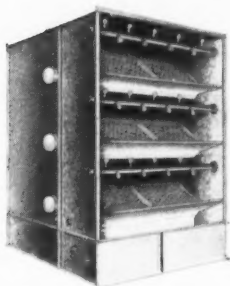
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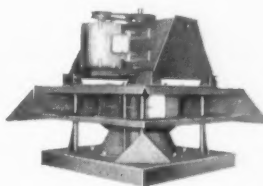
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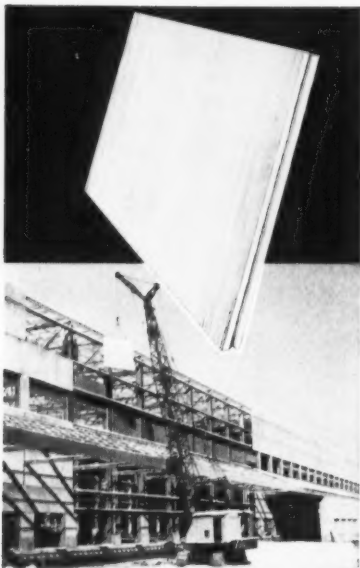
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### **TEXAS**

**Forrest and Cotton, Inc.**  
Dallas, Texas

¶ Plans and specifications for additions to water distribution system. \$250,000. Client, City of Terrell, Texas.

¶ Plans and specifications for water treatment plant. \$350,000. Client, City of Terrell, Texas.

¶ Report on water supply, treatment, and distribution. Client, City of Palestine, Texas.

¶ Plans and specifications for additional airfield facilities, Love Field, Dallas, Texas. \$160,000. Client, City of Dallas, Texas.

¶ Plans and specifications for additions to water distribution system, Contract No. 2. (civil) \$150,000. Client, City of Richardson, Texas.

¶ Plans and specifications for water pumping station and ground storage tanks. (civil, struc., elec.) \$240,000. Client, City of Richardson, Texas.

**Fuad S. Maayeh**  
Dallas, Texas

¶ First Baptist church, Arlington, Texas. (struc.) \$325,000. Client, Leinbauch Brothers, Architects.

¶ Allied Printing Company office building, two-story concrete frame and precast concrete joist slabs, Dallas, Texas. (struc.) \$100,000. Client, Jacob E. Anderson, Architect.

¶ Bowling alley for Curtis Sanford, Dallas, Texas. (struc.) \$350,000. Client, Jacob E. Anderson, Architect.

**Millwee and Associates**  
Bellaire, Texas

¶ Venetian Estates subdivision, Sugar Land, Texas. Water lines, sewer lines, paving, drainage, and bridges. (civil, struc., mech., elec.) \$750,000. Client, Sugarland Industries, Inc.

¶ Sewage treatment plant. (civil, struc., mech., elec.) \$125,000. Client, City of Liberty, Texas.

¶ Sewage treatment plant, paving and drainage, water plant facilities, and control system. (civil, struc., mech., elec.) \$527,000. Client, City of Deer Park.

**M. R. Mitchell & Associates**  
San Antonio, Texas

¶ Plans for a 5.6-mile urban expressway project in San Antonio, Texas. (civil) \$3,750,000. Client, the Texas State Highway Department.

### **VERMONT**

**Thomas W. Reed**  
Pittsford, Vermont

¶ Rehabilitation of overhead distribution facilities (\$10,000) at Fort Ethan Allen, Verooski, Vt.; replace direct burial cable with concrete encased duct and hand hole system (\$95,000); rehabilitation of interior wiring for new loads in four hangars (\$50,000); renew or rehabilitate transformer structures for hangars (\$20,000). (elec.) Client, United States Air Force.

### **VIRGINIA**

**Fortune Engineering Associates**  
Alexandria, Virginia

¶ Chancery building, Canberra, Australia. Three floors, vehicular tunnel, terrace retaining walls. (struc.) Client, Milton Grigg & Assoc., Alexandria, Va.

**Commonwealth Engineers**  
Richmond, Virginia

¶ New mechanical engineering building, University of Virginia. \$1 million (est.) Client, State of Virginia.

**Herbert L. Bregman, P.E.**  
Norfolk, Virginia

¶ Virginia Crusty Pie addition, Portsmouth, Va. (mech.) \$11,000. Client, Leavitt Associates, Architects.

¶ Lieberman residence, Newport News, Va. 5500 sq ft, heating and air conditioning. (mech.) \$12,000. Client, Leavitt Associates, Architects.

¶ Development projects, electro-mechanical services, Norfolk, Va. (mech.) Client, Tabet Manufacturing Company, Inc.

### **WASHINGTON**

**Cornell, Howland, Hayes & Merryfield**  
Corvallis, Oregon

¶ Design 1900 sq ft fire station of concrete block construction, including connection to all utilities and design of 24-ft paved road, Camp Adair AFB. (civil, struc., mech., elec.) \$50,000. Client, Corps of Engineers, Seattle, Wash.

¶ Design 1700 sq ft cold storage building of concrete block construction, including connection to all utilities, Camp Adair AFB. (civil, struc., mech., elec.) \$47,500. Client, Corps of Engineers, Seattle, Washington.

### **WEST VIRGINIA**

**Irving Bowman and Associates**  
R. N. Shepard, Consulting Engineer  
Charleston, West Virginia

¶ National radio astronomy observatory, Green Bank, W. Va. (civil, struc., mech., elec.) works area building (\$130,000); residence hall and cafeteria (\$420,000); laboratory building (\$450,000); central sewer and water system (\$100,000); underground electrical distribution system (\$50,000). Client, Associated Universities, Inc.

### **WISCONSIN**

**Scott Engineering Company**  
Watertown, South Dakota

¶ Dial modernization, telephone. (elec.) \$500,000. Client, Farmers Independent Telephone Company, Grantsburg, Wis.

### **WYOMING**

**Miner and Miner, Consulting Engineers, Inc.**  
Greeley, Colorado

¶ 120-mile rural telephone system near Hamilton Dome, Wyo. (elec.) \$130,000. Client, Tri County Telephone Association, Inc., Basin, Wyoming. ▲▲

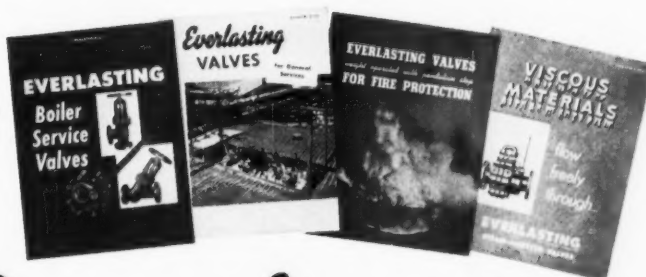


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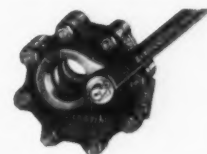
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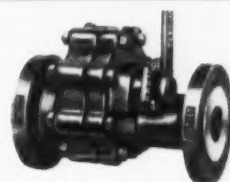
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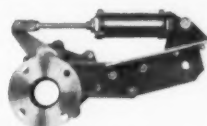
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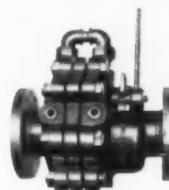
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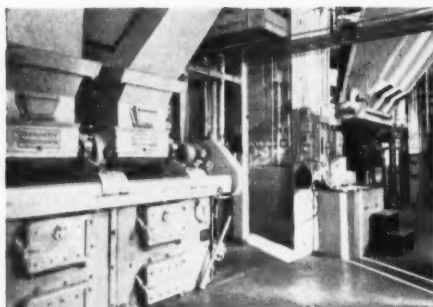
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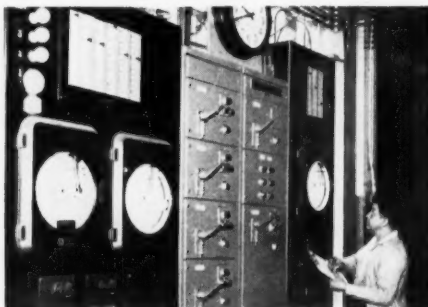


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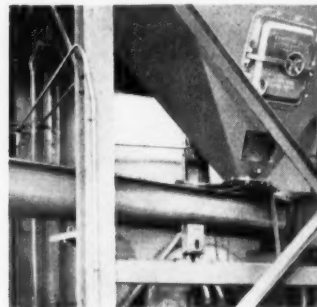
For automatic drains or emergency shut off.



Firing aisle of Carlisle's power plant. Left foreground is new 20,000 lb/hr boiler by E. Keeler Co., fired by Detroit Rotostokers. In the rear is an Erie City Water Tube Boiler (equipped with Erie City Spreader Stokers), used as stand-by unit.



Close-up of control panel, by Hagan Corp. These controls—regulating furnace draft, steam flow, air flow, flue gas temperature, stoker control—constitute a complete, automatic combustion control system.



Fly ash is collected by this Prat-Daniel Mechanical Precipitator. Fly ash is gravity-fed from the hopper (at top of photograph) into completely-enclosed screw conveyor which moves it cleanly to the disposal point.

# Carlisle Tire takes fuel costs for a ride

**With increased fuel efficiency, Carlisle Tire and Rubber burns coal . . . holds costs to minimum while upping production 20%**

At the Carlisle Tire and Rubber Division of Carlisle Corp., Carlisle, Pa., the steam produced by the power plant is used primarily for processing. As production of bicycle tires, inner tubes and other rubber products increased, the firm's engineering department decided to boost steam capacity with modern coal-burning facilities. Coal was used on the basis of cost—25% less than the nearest competitive fuel. The result has been a dependable steam supply, cleanliness of operation and a jump in operating efficiency. Today the plant consumes the same tonnage of coal as before modernization although production has increased 20%!

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Today, *when the annual cost of fuel often equals the original cost of the boilers*, you should know that bituminous coal is the lowest-cost fuel in most industrial areas. And modern coal-burning equipment gives you 15% to 50% more steam per dollar, while automatic operation trims labor

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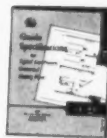
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Exterior view of Carlisle's power plant. From outside storage area, coal is moved to 32-ton bunker inside and fed by screw conveyor to coal hoppers. Coal handling system is by Jeffrey Manufacturing Co.

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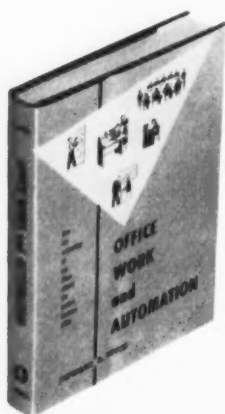
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PRINCIPLES AND APPLICATIONS OF  
RANDOM NOISE THEORY, by Julius  
S. Bendat; John Wiley & Sons, Inc.,  
N.Y.; 483 pp.; \$11.00.

*Reviewed*

*by*

A. A. Gerlach

*Cook Research Laboratories*

This timely book covers, in a thorough and comprehensive manner, the principal results of the marriage of statistics and circuit theory, now a little more than a decade old. The book compiles that material on the subject of statistical communication theory which has accrued in the various technical journals during this period. It will be a welcome addition to the personal library of those theoretically inclined engineers who desire a well defined and orderly treatment of the subject matter.

The book is divided essentially into two parts. The first three chapters deal with the development of the principles of statistics, power spectra, and probability theory. The remaining seven chapters deal with the application of these fundamental principles to the formulation, solution, and interpretation of selected problems in the field of statistical communication theory.

Optimum filtering and prediction, power spectra evaluation and interpretation, analog computer techniques, correlation measurements, and zero-crossing properties of random processes are the principal topics treated. Studies of continuous phenomena rather than discrete events, and methods of

analysis rather than modern algebras are employed. The underlying motivation for most of the applications has been concrete noise problems in guidance and control system work, reflecting the author's experience in such problems at the Ramo-Wooldridge Corporation.

In the early chapters of the book the author devotes a considerable effort to generalize his analysis to cover the case of random or stochastic processes. He then illustrates the simplifications which may be made if the processes were first stationary and then ergodic. Emphasis is continually placed on the errors which may result if the time-series treated are indiscriminately treated as ergodic. For many of the applications, however, solutions may be obtained only for the more particular case of the ergodic process.

Although the author purports that no previous background in statistics or special material in probability and analysis is required for a complete understanding of the material in the book, it is highly recommended by this reviewer that the reader possess a reasonable degree of mathematical sophistication. The book itself does not delve into any rigorous mathematical treatments, but rather employs engineering and physical arguments, to a large extent, in developing the analytical formulations. Since this is a first edition by this author, a number of errors have been noted in the mathematical developments, however,

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these errors are of a minor nature, and in no way detract from the stated results.

The book should be welcomed enthusiastically by the consulting engineer who wishes to keep abreast of the latest analytical developments in the fast moving field of statistical communication theory.

**ISOTOPES: A BIBLIOGRAPHY OF UNITED STATES RESEARCH AND APPLICATION 1955-1957; 267 pp.; \$2.25.**

This report is a bibliography of open-literature references to United States research into reactor-produced radioactivity and applications of radioisotopes in medicine, industry, and agricultural. It is a guide to the technical aspects of isotope research and utilization and contains nearly 6000 references categorized into 30 fields of work with radioactive and stable isotopes. Reference is made to material appearing in scientific, technical, and professional journals during the three years ending December 1957. An author index and a key to journal abbreviations are included.

The report, TID-3076, is available from OTS, U.S. Dept. of Commerce, Washington 25, D.C.

**PLANNING AND DEVELOPING THE COMPANY ORGANIZATION STRUCTURE**, by Ernest Dale; American Management Association, N. Y.; 336 pp.; \$4.75 to nonmembers; \$3.50 to AMA members.

Although written specifically for industrial plant management rather than for either medium size or large consulting firms, there is a wealth of information in this book to help the consultant — whose firm is growing fast, who is thinking of expanding into new fields, or is considering the addition of partners — get and maintain a sound footing insofar as his firm's organization is concerned.

Of particular interest to the busy consultant is the chapter devoted

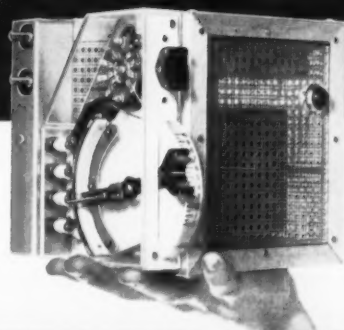
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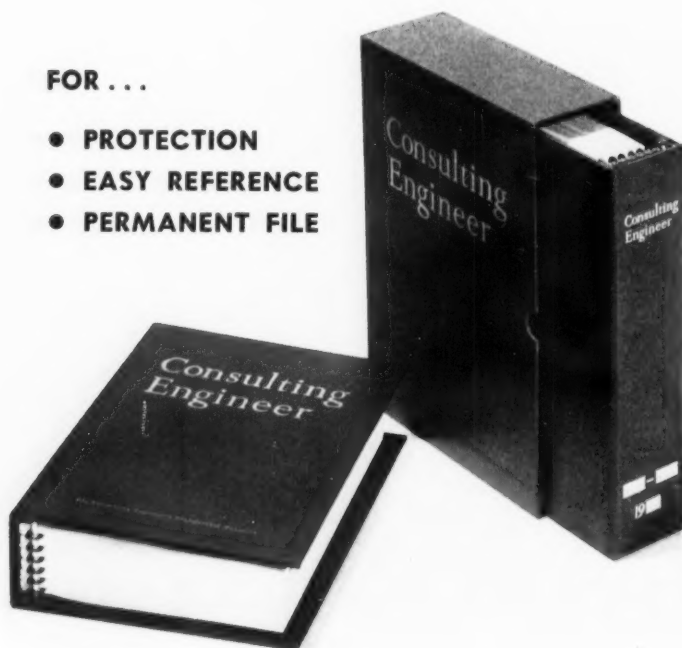
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PRINCIPLES AND PRACTICE OF FLOW METER ENGINEERING, 8th Edition, by L. K. Spink; The Foxboro Company; 549 pp.; \$15.00.

Reviewed

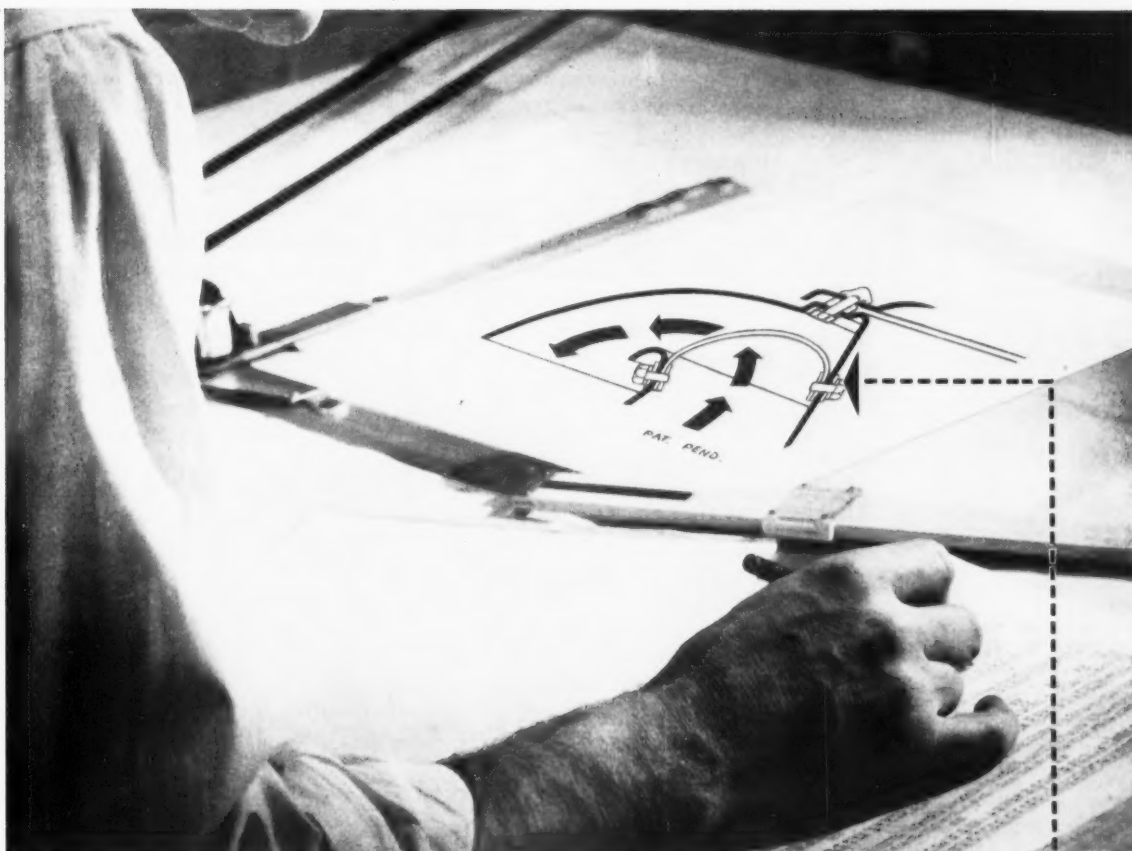
by

Woodrow W. Ramsey  
Ramsey & Reeves

This authoritative textbook on the head meter is so arranged that it can be used as a handbook to readily solve daily problems of commercial measurement.

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The book uses drawings, photographs, tables, and curves generously. Primary devices (produce differential pressure), secondary elements (measure differential pressure), different tap locations, and meter mechanisms (an integral part of automation) are covered thoroughly. The chapter "Choice of Head Meter Specifications" is a very practical approach to choosing a meter for a specific application. The appendix contains empirical equations for discharge coefficients, for AGA correction factors, and for expansion factors. The unusually complete index facili-



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ENGINEERS can rely on this authoritative reference to provide instant help in virtually every phase of calculating structural loads. It supplies proved techniques and explains sound principles for accurately figuring the design requirements of both statically determinate and statically indeterminate structures. From roof trusses to highway bridges, the book enables you to pinpoint the direct stress, shear and bending moment, and deflection for any structural member. Especially helpful is its clear and detailed explanation of how influence diagrams are most effectively used to determine critical positions of moving loads and their maximum values. In addition, it demonstrates how to apply three highly useful methods of analyzing statically indeterminate structures.



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tates use of this book, and the extensive bibliography contains a wealth of other source material which can be used for further study.

*Principles and Practice of Flow Meter Engineering* is a must for the engineer whose field of specialization includes measurement of fluid flow, whether for rate of flow only or for extension into the field of automation.

**MOMENT DISTRIBUTION FACTORS FOR BEAMS OF TAPERED I-SECTION**, by James M. Gere; American Institute of Steel Construction, Inc.; 40 pp.

This book presents in graphical form the coefficients and factors which are necessary for the analysis of steel structures involving tapered beams by the moment distribution method. The graphs give fixed-end moment coefficients, stiffness factors, and carry-over factors for beams of I-section or box section. Beams have a uniform taper along their length.

Copies of the book are available on request from the American Institute of Steel Construction, Inc., 101 Park Ave., N.Y. 17, N.Y.

A new price list of over 4000 AEC unclassified research reports for sale by OTS, U.S. Dept. of Commerce, Washington 25, D.C. is available. This cumulative listing, AEC Research Reports Price List No. 30, includes new documents acquired since January 1958. Price lists are issued semiannually; the next list will be available in February 1959.

OTS also publishes *U.S. Government Research Reports*, a monthly publication which lists new research reports as soon as they are released by the AEC. It also describes reports from the Army, Navy, Air Force, and other Government agencies available to the public. This publication may be obtained on a subscription basis from

Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at \$6 a year.

The Expansion Joint Manufacturers Association has just released a new edition of *Expansion Joint Standards* containing up-to-date information concerning the design, construction, application, and testing of metallic packless expansion joints for piping and other services. Much of this information has never been published in any text or reference book.

Copies of the 32-page edition may be obtained from George P. Byrne, Jr., Secretary, Expansion Joint Manufacturers Association, 53 Park Place, N.Y. 7, N.Y. Price is \$1.00 per copy.

"PEOPLE AND MOVEMENT," Portland Cement Association, color, sound, 17 min.

Produced as a public service, this film is aimed at increasing the public's understanding of the planning behind the new interstate highways. It also discusses the changes in America's population and how these changes are affecting land use and movement in urban, suburban, and rural areas of the nation.

Scenes from all over the country show super expressways, redevelopment models, slum clearance projects, and rural industrial developments. Some particularly dramatic footage taken from a helicopter shows southern California freeways. The film is available through any of the Portland Cement Association's 32 district offices.

"YOUR UNTAPPED TREASURE," a new slide presentation providing a graphic story of water resources and pumping techniques, is now available from Layne & Bowler Pump Company. It traces water from its sources to the well sites and describes various water-bearing



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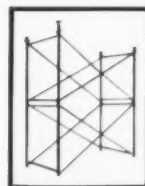
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ing formations, methods of well-drilling, and pumping techniques. Descriptions of deepwell pumps and their operation also are included in the story.

Arrangements for showings can be made through offices of the company in Los Angeles and Fresno, Calif.; Chicago, Ill.; Hastings, Nebr.; Monroe, La.; Twin Falls, Idaho; and New York City.

**STANDARD STRENGTH AND EXTRA STRENGTH PERFORATED CLAY PIPE**, a recommended revision of Commercial Standard CS143-47, has been released by the Commodity Standards Division, Office of Technical Services.

It provides definitions and requirements for standard strength and extra strength glazed or unglazed perforated vitrified clay pipe in the sizes normally produced. The standard is meant to serve as a primary reference to existing nationally recognized specifications.

Limited copies of the revision, designated TS-5413, are available on request from the Commodity Standards Division, U.S. Department of Commerce, Washington 25, D.C.

**INTRODUCTION TO THE DESIGN OF SERVOMECHANISMS**, by John L. Bower and Peter M. Schultheiss; John Wiley & Sons, Inc., N. Y.; 510 pp.; \$13.00

*Reviewed  
by*

*Cecil W. Armstrong  
Consulting Engineer*

This well written and generously illustrated book should be of interest to all consulting engineers dealing with control problems of physical quantities whether they involve position, velocity, temperature, chemical composition, or any other measureable and controllable entity. Basic principles of feedback system design and a systematic approach dealing with the principal performance requirements such as

harmonic response and time response error coefficients, are covered by the authors.

The book begins with the definition that a device is a servomechanism if it satisfies the following description: "The device controls some physical quantity by comparing its actual value  $C$  with its desired value  $R$  and uses the difference (or error)  $R-C$  to drive  $C$  into correspondence with  $R$ ."

The authors then generalize the definition and after an interesting first chapter on basic concepts of control, lead the reader into mathematical introduction. As clearly stated in the preface to the book, an understanding by the reader of linear circuit theory and linear differential equations is assumed. The chapter on mathematical introduction discusses the need for and gives examples on the use of mathematical devices such as linear differential equations, functional transformations, the Fourier series, complex Fourier series, and the Laplace transformation.

Throughout the text many illustrated examples are given along with problems for the reader to solve. The book contains an appendix covering servomechanism components which is helpful for reference in following the examples and in solution of the problems.

Chapter headings include Harmonic Analysis, Feedback, The Nyquist Criterion, The Bode Diagram, Performance Criteria and Design Techniques, Minor Loops, The Root-Locus Techniques, Statistical Considerations, and Nonlinearities in Servomechanism Design.

Although the consulting engineer may not be involved directly in the design of servomechanisms, the book should be a useful addition to his library for reference to the principal approaches to the design of feedback control systems.

Written specifically for highway and lighting engineers, the *Highway Lighting Reference Guide* is



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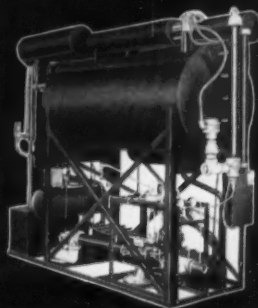
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the first publication of a complete engineering analysis of where and how the nation's highways should be lighted. Based on American Standard Practices for Street and Highway Lighting, as developed by the Illuminating Engineering Society for the American Standards Association, the new booklet covers the most important aspects of roadway lighting.

Types of lamps and design of luminaires are discussed; specifications, installation and maintenance, and standards and tests are reviewed; and lighting supports and power distribution are evaluated. Also discussed in detail are installations at intersections and interchanges, tunnels and underpasses, curves and hills, and urban area approaches.

Copies of the *Highway Lighting Reference Guide* are available for \$1 from the Street and Highway Safety Lighting Bureau, 1400 Terminal Tower, Cleveland, Ohio.

RECRUITING THE COLLEGE GRADUATE: A GUIDE FOR COMPANY INTERVIEWERS, by Richard S. Uhrbrook; American Management Association, N. Y.; 32 pp.; \$1.25 to nonmembers; \$1.00 to AMA members.

This booklet outlines and explains in detail the techniques to use to screen potential employees both during the preliminary campus interview and later on the company premises. For the consulting engineer planning his first visit to the college campus to recruit graduates, it is a valuable primer to the proper approach. A comprehensive bibliography is included to enable further research into the problems of hiring the right man.

A new guide to the planning and design of modern stagelighting installations for theaters, hotels, schools, and churches has just been published. *Lighting the Modern Stage* presents a short history of stagelighting, discusses the plan-

ning of the auditorium and the stage to produce optimum lighting effects, and includes engineering data relating to the specification of lighting equipment.

Copies are available from Ariel Davis Manufacturing Co., 3687 So. State St., Salt Lake City 15, Utah.

A STUDY OF CHARACTERISTICS OF FOAM-WATER SPRINKLER SYSTEMS IN CONTROLLING FULL-SCALE FIRES, by E. J. Jablonski, H. B. Peterson, and R. L. Tune, Naval Research Laboratory; 45 pp.; \$1.25.

This report describes a new type of sprinkler head designed for fire hazards involving flammable liquids in aircraft hangars. The sprinkler head is a combination foam and water nozzle delivering a spray pattern of foam when supplied with a 6 percent foam solution. Without the foam solution it performs as a normal water sprinkler head.

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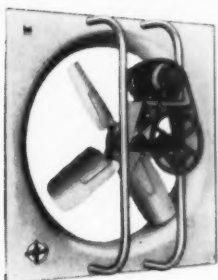
The booklet, PB 131740, may be ordered from OTS, U.S. Dept. of Commerce, Washington 25, D.C.

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This new movie on Lake Maracaibo's booming oil industry takes its title from the fabled city of gold sought by Spanish explorers.

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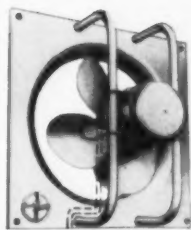
The film may be obtained for showings by writing to the nearest regional office of Association Films, Inc. These are located in Ridgefield, New Jersey; LaGrange, Illinois; Dallas, Texas; and San Francisco, California.



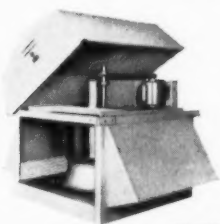
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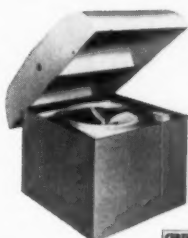
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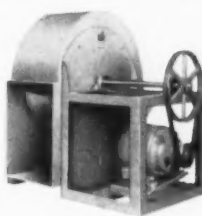
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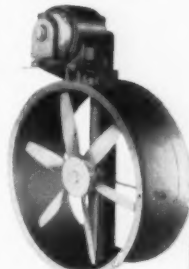
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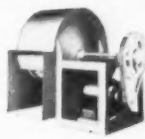
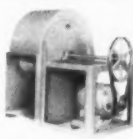
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## Consulting Engineers' Calendar

*Jan. 14-15.* Building Research Institute; Conference on Noise Control in Buildings, Hotel New Yorker, New York, New York.

*Jan. 19-22.* American Road Builders' Assn.; Annual Convention, Dallas Memorial Auditorium, Dallas, Texas.

*Jan. 24-27.* Consulting Engineers Association of California; Sixth Annual Meeting, Mark Thomas Inn, Monterey, California.

*Jan. 26-29.* American Society of Heating and Air Conditioning Engineers; Fourteenth International Heating & Air Conditioning Exposition, Convention Hall, Philadelphia, Pennsylvania.

*Jan. 27-29.* Society of Plastics Engineers; 15th Annual Technical Conference, Hotel Commodore, New York, New York.

*Feb. 1-4.* American Society of Heating and Air Conditioning Engineers; Annual Meeting, Baker and Adolphus Hotels, Dallas, Texas.

*Feb. 1-6.* American Institute of Electrical Engineers; Winter General Meeting, Statler Hotel, New York, N. Y.

*Feb. 3-5.* Society of the Plastics Industry, Inc.; Reinforced Plastics Division Conference, Edgewater Beach Hotel, Chicago, Illinois.

*Feb. 9-13.* American Society of Civil Engineers; Los Angeles Convention, Statler Hilton Hotel, Los Angeles, California.

*Feb. 15-19.* American Institute of Mining, Metallurgical and Petroleum Engineers, Inc.; Annual Meeting, St. Francis, Sheraton Palace, and Sir

Francis Drake Hotels, San Francisco, California.

*Feb. 19-21.* National Society of Professional Engineers; Winter Meeting, Dinkler-Tutwiler Hotel, Birmingham, Alabama.

*Feb. 23-26.* American Concrete Institute; Annual Convention, Statler Hilton Hotel, Los Angeles, California.

*March 3-5.* American Institute of Electrical Engineers; Western Joint Computer Conference, Fairmont Hotel, San Francisco, California.

*March 8-12.* American Society of Mechanical Engineers; Gas Turbine Power Conference and Exhibit, Netherlands-Hilton Hotel, Cincinnati, Ohio.

*March 16-20.* National Association of Corrosion Engineers; Hotel Sherman, Chicago, Illinois.

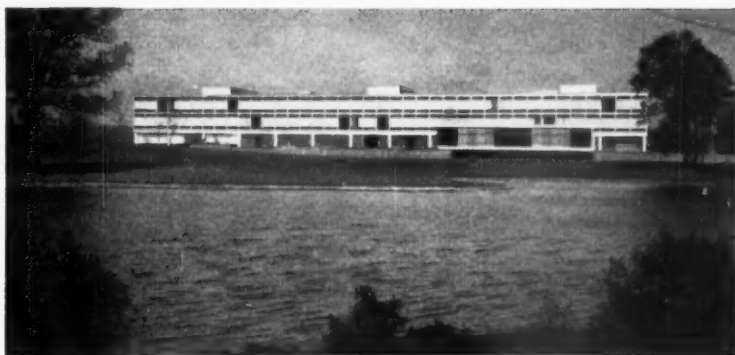
*March 29 - April 1.* American Society of Mechanical Engineers; Instruments and Regulators Conference, Case Institute of Technology, Cleveland, Ohio.

*March 31 - April 2.* Illinois Institute of Technology; Twenty-First American Power Conference, Hotel Sherman, Chicago, Illinois.

*April 5-10.* Engineers Joint Council; Nuclear Congress, Municipal Auditorium, Cleveland, Ohio.

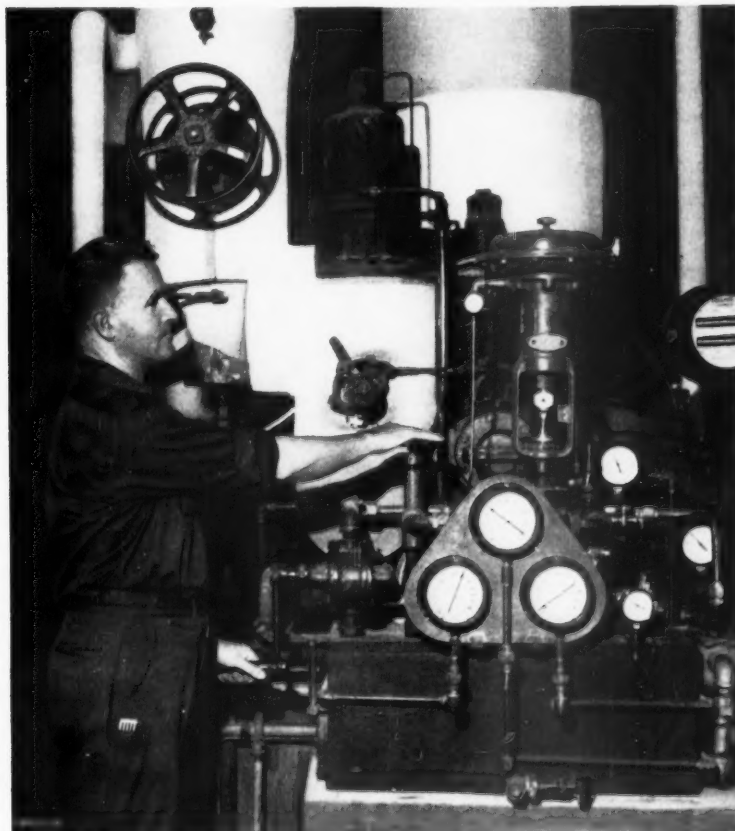
*April 6-8.* Building Research Institute; Annual Meeting, Penn-Sheraton Hotel, Pittsburgh, Pennsylvania.

*April 19-23.* American Society of Mechanical Engineers; Oil and Gas Power Conference, Shamrock-Hilton Hotel, Houston, Texas.



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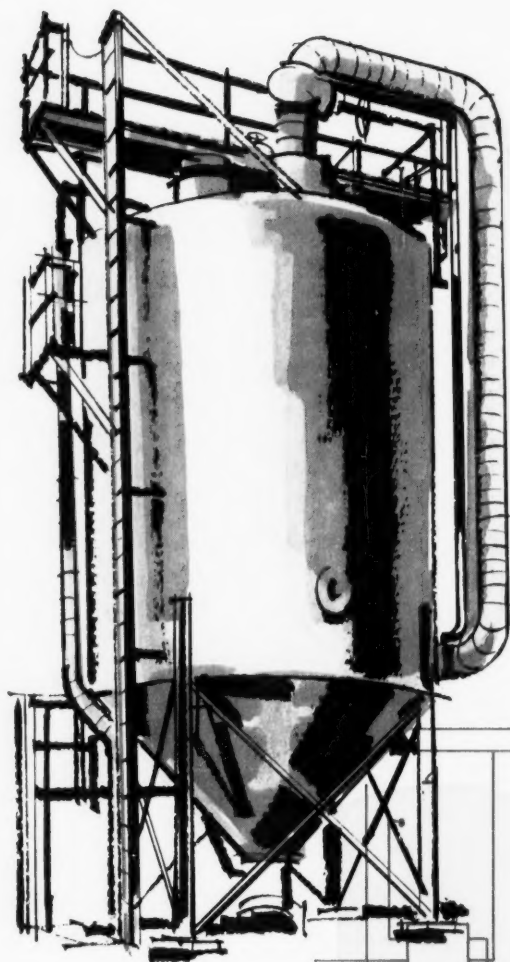


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